SCIENTIFIC AMERICAN

PLANTING A MINE FIELD—ANCHOR IN THE FOREGROUND, BUOYANT MINE ON THE DAVITS

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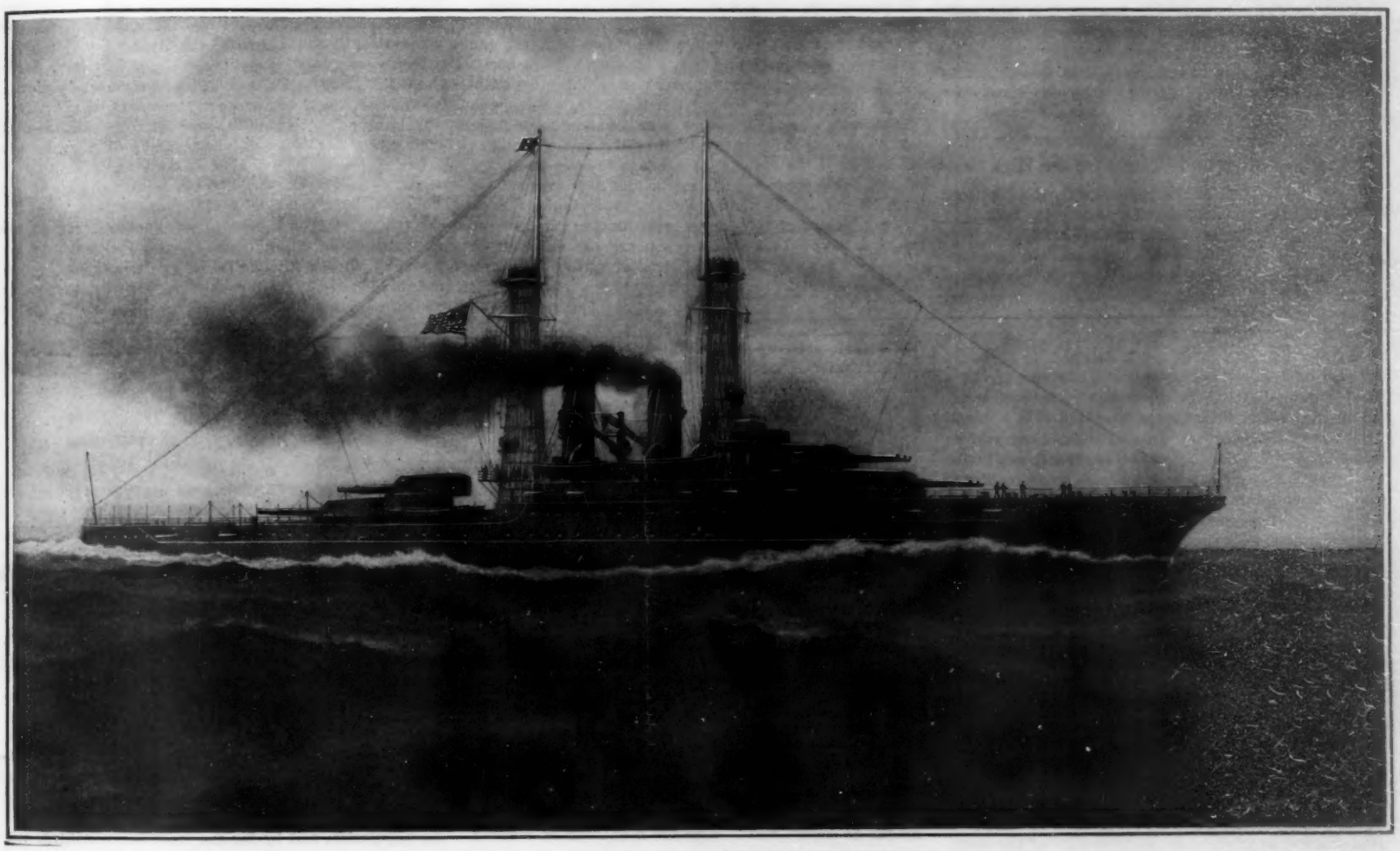


Displacement, 32,000 tons. *Speed*, 21 knots. *Armor*, belt, 14"; turrets, 18". *Guns*, twelve 14" 50-caliber; twenty-two 5". *Torpedo-tubes*, four 21-inch. *Complement*, 1056 officers and men.

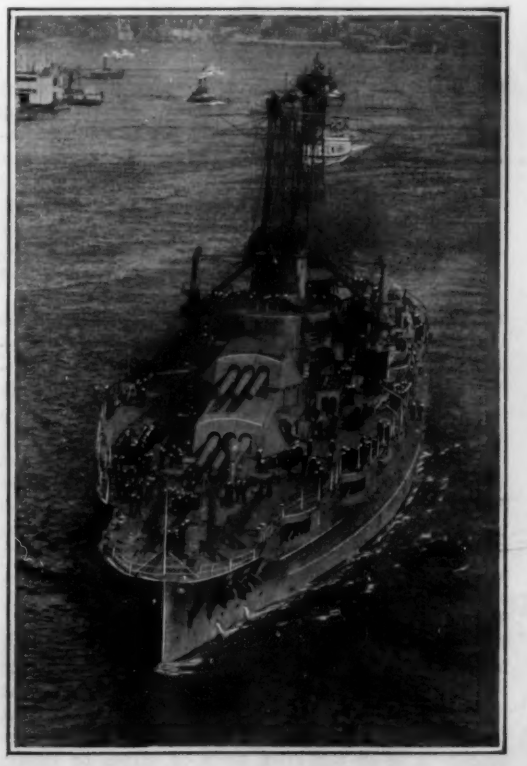
The U. S. dreadnought "New Mexico." Also "Mississippi" and "Idaho." These ships are now under construction

Our Latest Dreadnought, the "New Mexico"

LATE dispatches from the Balkans, in mentioning the taking over of the Greek fleet by the Allies, have stated that it included two battleships which formerly belonged to the United States Navy. When they flew our flag, these ships were known as the "Idaho" and "Mississippi." Subsequently to their sale to Greece, when the question of the new naval program came before Congress, it was decided to build three new dreadnoughts in place of two, applying the purchase price of the "Idaho" and "Mississippi" toward defraying the cost of a third battleship. The three ships thus authorized were laid down in the Fall and Winter of 1914. When they are launched they will be known as the "New Mexico," the "Idaho" and the "Mississippi."

The "New Mexico" class will contain some marked improvements on the "Pennsylvania" and "Arizona," which precede them. The "Pennsylvania," built at Newport News, was completed during the Spring of this year, and recently during the test of her main batteries in the Chesapeake, when firing from a fixed position at a fixed target 20,000 yards distant, she made the remarkable score of eight hits out of 24 rounds with her 14-inch guns. We present an unusually fine bird's-eye view of this ship as she was steaming down the East River after undergoing some tuning up at the Brooklyn Navy Yard. Her sister, the "Arizona," has recently been completed at this same yard, and in these two vessels (unless something larger and more powerful has since been built by England or Germany) with their 31,400 tons displacement, and batteries of twelve 45-caliber, 14-inch guns, the United States possesses the two greatest warships afloat.

Of the three new ships, the "New Mexico" is under construction at the Brooklyn Navy Yard, the "Idaho" at the New York Ship Building Company's yard, and the "Mississippi" at Newport News. The most noticeable difference between the "New Mexico" and the "Pennsylvania" is in the form of the bow, the "Pennsylvania" having the conventional straight stem, whereas the bow of the "New Mexico" is of the clipper



Battleship "Pennsylvania" showing forward 3-gun turrets

shape, which was prevalent in the days of the sailing ship and in the earlier years of the steamship.

The great punishing power and extreme penetrating range of modern naval ordnance have made it certain that one or the other of two contending ships will be so severely handled before it can get within ramming distance, that ramming, as part of the tactics of a modern sea fight, has ceased to be seriously considered. Hence the decision of our naval constructors to omit the ram altogether, and build our future battleships with the outwardly-curving stemhead, and bows widely flaring above the waterline which characterize the clipper bow. Not only will deadweight be saved by this construction, but the turning ability of the ship will be somewhat improved, and the fuller lines above the waterline will give to the "New Mexico" and her sisters superior seagoing qualities when driving hard into a head sea.

The ships of the "New Mexico" class are enlarged "Oklahomas," of 4,500 tons greater displacement and mounting two additional 14-inch guns. The armor protection is somewhat heavier, and the protection against under-water attack has been amplified by the further extension of the subdivision and by the provision of improved anti-torpedo bulkheads, designed to localize the effect of the very heavy explosive charges carried in the head of the latest torpedoes.

The "New Mexico" has a long forecastle deck, which is carried aft to the main lattice mast. Forward on this deck are two turrets, each containing three 14-inch guns, those in the after turret firing above the roof of the foremost turret. On the main deck, aft are two three-gun turrets similarly disposed. This gives a concentration of six 14-inch guns ahead, six astern and a broadside fire of twelve 14-inch guns.

The three guns in each turret are mounted in a common sleeve, and are elevated, trained and fired as one

(*Concluded on page* 395)

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Law of Search and Seizure on the High Seas

AT the opening of the present war, there existed a code of International Laws covering both land and sea operations, one of the principal objects of which was the protection of the civilian non-combatant. Conspicuous among these laws was that governing the right of search and seizure of belligerent and neutral merchant ships.

The Law of Search and Seizure, at least so far as its motives and principles are concerned, is centuries old. Its most important provision is the outcome of a growing recognition of the rights of the non-combatant, and an expression of that enlightened spirit of humanitarianism which has marked the growth of our modern civilization. We refer, of course, to that clause in the law which safeguards the lives and comfort of the passengers and crews of a captured ship, by demanding that they shall be removed to a place of safety before the ship is sent to the bottom.

In all naval wars of the past, the effort to crush the enemy has taken the form of major operations against his fighting ships and minor but very extensive operations against his ships of commerce; and it is in connection with the latter activity that the Law of Search and Seizure has grown to its present clearly-defined provisions, which, by the way, have of late years received the endorsement of the Hague conventions. Under the law, a belligerent ship has the right to stop any merchant ship upon the high seas and send a boarding party to examine its manifest, and if need be, its cargo. Should the ship's papers be found correct, she is allowed to proceed. If the boarding officer finds that the ship is a neutral ship carrying contraband of war, or if he is doubtful as to the absolute neutrality of her cargo, he may either put a prize crew aboard and take her to port to await the decree of a prize court (we are speaking here, of course, of neutral ships); or in the case of a belligerent, after transferring the passengers and crew to his own or another vessel, he has the right to sink the ship there and then.

The question naturally arises: what is meant by the law when it demands that the safety of the crew must be insured? The answer is to be found in the universal practice of civilized nations during several centuries. Either the captured ship has been sent into port in care of a prize crew, or, if that were not possible and it was necessary to sink the ship, the passengers and crew were taken care of aboard the enemy ship.

There was, of course, an important exception to this universal acknowledgment of the cause of humanity. We refer to piracy, a kind of warfare which recognized no established law save that of its own necessity. The pirates solved the problem of passengers and crew by making them "walk the plank," before they looted and burned a prize with which they were not able to burden themselves.

When Germany realized that her merchant fleets had been swept from the high seas and shut up in her own or neutral ports, she sent out her submarine raiders to attack belligerent merchantships and such neutral vessels as might be carrying contraband of war to the enemy. In doing so, the German Government knew perfectly well that, because of the inherent limitations of the submarine, it would be impossible to carry on a campaign of this kind consistently with the Law of Search and Seizure. They were well aware that the scrupulous fidelity with which that gallant officer, Capt. Muller of the "Emden" had obeyed the law, by taking care of the passengers and crews of the captured ships, would be impossible in the case of the submarine. Capt. Muller, at great inconvenience to himself, took with him a large ship to which he transferred the crews of captured ships. Such a thing, of course, was impossible in European waters, which were dominated by the fleets of the enemy. The only way in which an enemy or neutral ship could be sunk was to put a torpedo into her on sight and send ship and crew to the bottom.

In other words the German Government was confronted with the alternative of piracy or nothing.

We know what happened. Germany cut loose with a ruthless submarine war, and non-combatant passengers and crew "walked the plank" by the thousands. She sank ships, big and little, without the slightest regard for life. Every ship so sunk was a memorial to Germany's contempt for the humanitarian laws of war, and among these memorials the "Lusitania" horror stands supreme and will continue to lift its accusing head as long as time and memory endure.

Over one hundred American citizens, among them some of the best-known and most highly-honored of the land, went down with that ship. As the outcome of diplomatic protests and much writing of notes, Germany conceded the point that she would not sink ships unwarned, and that she would make provision for the safety of passengers and crews by setting them adrift in open boats. Safety forsooth! A child can understand that to dump several hundred men, women and children into boats fifty miles from land, and leave them to the chance of being swamped by the first sea that is kicked up by half a gale of wind, is to offer them, not safety, but a ten-to-one chance against their ever setting foot on dry land. Should the Germans continue their U-boat campaign off our coasts during the winter months, it would take but a few hours' exposure to zero temperature to snuff out the lives of such women and children as might be cast adrift.

This U-boat raid at our very doors has shaken the American people out of their lethargy, or shall we say, indifference, in respect of certain burning questions of an international character that have arisen during the great war. We felt, in a vague way, that the compromise which our State Department made with Germany on the question of saving non-combatant life was not altogether satisfactory. Thanks to the unfathomable workings of the German official mind, as exemplified in the visit of U-boat 53, the people of this country have now had a close view of U-boat methods, which is going to dominate any future negotiations that we have with Germany on this subject. It was due to the opportune intervention of the United States destroyers and not to any great German solicitude for human life, that we were spared the sight of wholesale destruction of non-combatant life before our very doors.

It is not to be inferred that the unexpected call at Newport of an unwelcome visitor was simply an experiment with the object of testing out how far methods of this kind could be resorted to and accepted by our people and by our Administration without resentment? In case we should remain docile after such an experience and the practice of sending the dreaded submarine into our ports should be pursued, must not an absolutely rigid adherence to the real intent of International Law as far as search and seizure are concerned be insisted upon on the part of the Administration?

The placing of passengers and crews of unarmed belligerent and neutral merchantmen in small boats on the high seas has introduced a new element in naval warfare which is repugnant to the laws of humanitarianism and which our people, now that they may view the flagrancy of the practice at close range, are not very likely to accept with complacency.

A Warning

THE absolute secrecy with which the merchant submarine "Deutschland" and, later, the fighting submarine U-53 made their way into the Chesapeake and Narragansett Bays, should serve as a note of warning to the United States.

Whether or not the German Government sent this fighting submarine across for the express purpose of showing the United States that she was capable, if she so wished, of running amuck among our shipping, the instant it ventured beyond the three-mile limit, is a matter for conjecture. But this much is certain, that after these visits, it will be our own fault and not Germany's if we fail to realize that what she did to merchant shipping off our coasts, she could just as easily do to the naval and merchant shipping within our own dockyards and harbors.

To be more explicit, we mean that if we should get into further controversy with Germany over this U-boat raiding, and the discussion should reach the critical phase of an impasse, it would be an easy matter for Germany to repeat the silent entrance into our harbors, not with solitary submarines but with flotillas of them, one for each port, and make a clean bag of our whole fleet in the Atlantic.

Why not? This would be merely letting war itself make its own declaration of war, as the Japanese did in their surprise destroyer attack at Port Arthur. And if such a raid were made, say by a dozen submarines, the loss of our whole first fighting line of twenty-one dreadnoughts in the brief space of fifteen or twenty minutes would be a perfectly reasonable possibility.

If a reader should exclaim "Impossible!" we invite him (bearing in mind how perfect a surprise visit U-53 was able to make in broad daylight) to consider how simple a matter it would be for a couple of flotillas, say a dozen boats in all, to creep, during the night, into Narragansett Bay, and line up ready for attack just as soon as there was sufficient light for periscopic vision.

But what would there be to attack? Well; Narragansett Bay is the rendezvous for our Atlantic fleet, during the Summer season; and there are times when practically our whole first-line fleet is anchored in line formation within the Bay. If any attack were to be made it would take place as unheralded as was the visit of U-boat 53. And if the two flotillas moved down between the lines of our ships, steering a zig-zag course so as to bring bow and stern tubes to bear alternately, can it be denied that, among the one hundred torpedoes which the flotillas carried, there would be a sufficient number find the mark at such short range as to put our whole fleet at the bottom of the Bay?

Last year a book was published in this country under the title "America Fallen," which showed how perfectly possible it would be for enemy submarines to make a simultaneous attack, unpreceded by any declaration of war, upon our various unsuspecting dockyards and naval stations. The wholesale and swift sinking of ships, as portrayed in the book, was criticized at the time as being a visionary and impossible feat.

But this visit of U-boat 53 proves that, granted the existence of an international quarrel impossible of adjustment, such a raid, followed by disaster of the first magnitude, would be the chief among the dangers to which our unpreparedness exposes our first line of defense.

Would it not be well for a joint Army and Navy Board to elaborate a scheme for netting the entrances to our ports and dockyards as a matter of reasonable security?

Our Fragmentary Vital Statistics

"IT is with some feeling of mortification," says Dr. Cressy L. Wilbur, in a paper prepared for the Second Pan-American Scientific Congress and recently published by the Census Bureau, "that we are obliged to confess that the United States does not now possess the means of recording the births and deaths of all its inhabitants, a matter deemed most important among all civilized nations. It is with even greater regret that it must be admitted that, according to the present rate of progress, it will be many years before this object can be accomplished."

Dr. Wilbur's unhopeful view of the situation is important, because no other person has devoted more vigorous efforts than he to the task of rescuing this country from the state of downright barbarism in which it has hitherto existed with respect to the registration of vital statistics, and no one can speak with greater authority on the subject. At present a third of the population, and by far the most difficult third, still remains to be brought into the registration area for deaths alone, while about three fourths of the country lacks complete and thorough registration of births. Even in our oldest registration states the recording of births is still notoriously incomplete. Dr. Wilbur thinks we *may* have complete registration in this country by 1940 or 1950.

Records of births and deaths are a matter of personal interest in connection with such questions as the inheritance of property, remarriage, and the like; but they are of much greater interest as furnishing an essential part of sanitary and medical statistics and the basis of legislation on many public questions. Our Government is, at present, unable to fulfill certain treaty obligations concerning the reporting of the deaths of aliens to their countries, on account of the lack of registration of deaths in certain states.

Our anomalous position in the matter of vital statistics is one of the many unfortunate results of our decentralized form of government. The registration of births and deaths is still left to the states, which have diverse laws on the subject—and in some cases none at all—while the Federal Government can only transcribe and collate such statistics as the states may furnish.

Uniform state legislation on the subject is the aim toward which the propagandists of adequate vital statistics are at present working; and great progress has been made. But Dr. Wilbur emphasizes the fact that it is one thing to pass good laws and another to enforce them. The laws now existing on the subject of registration have been disregarded to a scandalous extent. Dr. Wilbur sees in this fact one of the many consequences of over-legislation. Here and there excellent results have been obtained by the systematic prosecution of delinquents, as in New York city since 1910, and for some years past in the states of Pennsylvania and Minnesota; but generally throughout the country the enforcement of registration laws does not yet seem to have public opinion back of it. A campaign of education would therefore seem to be what is most needed.

Aeronautical Notes

Flying from London to the Trenches.— It is reported that flying from the trenches in France to London and back again in the same day is becoming a not uncommon experience for officers of the British Army. The story is told of how a soldier recently left the trenches in France early in the morning, took a Turkish bath in London some three and a half hours later, lunched at one of the leading hotels in the British metropolis, and returned back to the trenches in the early evening.

The Gallaudet Seaplane.—Promising results have been obtained in the test flights of the Gallaudet seaplane built for the United States Navy. Of the several interesting features of this seaplane is the novel method of transmission between the twin engines of 300 horse-power and the single propeller, which makes it possible to operate the craft on either engine or both, as desired. Under the pilotage of David H. Mulloch, the machine is said to have displayed all the characteristics of an efficient flier.

Two Super-Zeppelins, with a maximum speed of 80 miles an hour and a cruising radius of action of 3,000 miles, have been constructed by Germany according to an announcement made by Lord Montagu of Beaulieu in a recent speech. Four additional Zeppelins, of the same type as the two already constructed, are now being built, stated the same authority, and each can accommodate a load of bombs of five tons. The principal features of the craft are a capacity of 2,000,000 cubic feet, a length of 780 feet, a beam of 80 feet, and six or seven engines of a total of 15,000 horse-power.

Receiving Wireless Messages On Board Aeroplanes has heretofore been almost impossible because of the intense noise of the engines and propellers, and the faintness of the signals in the telephone receivers. With a view to making possible the reception of wireless signals by aviators, two Harvard men, Cutting and Washington, have developed a brass helmet which, when worn by aviators, is said to eliminate effectually the noise of the engines and the propellers. The helmet covers the head of the wearer and rests on his shoulders. A telephone receiver headband is worn in the usual manner. Virtually, the wireless operator is now using a sound-proof booth.

North Sea Naval Battle and Zeppelins.—Writing recently in the *Daily Telegraph*, a British authority points out how the Zeppelins served the German fleet to good stead when it encountered the British Grand Fleet. He writes as follows: "At 9 o'clock the Great German Fleet, at least 60 vessels of all descriptions, was sighted. It was carefully guided by three Zeppelins. At 6 o'clock in the evening the same fleet was viewed farther north, and this time, with its attendant airships, was steaming furiously eastwards. What had happened in the meantime? This, too, is equally clear from reports of other Dutch captains. At 5 o'clock in the afternoon they saw one or more British squadrons much farther south than the 6 o'clock position of the German fleet, heading almost due north in the direction of the enemy. Something else they noted. From the northwards appeared three Zeppelins. The airships, immediately on spotting the British vessels, went about in the direction of the main German fleet. Then came a swift dash. Half an hour afterwards the High Cannal Fleet was in mad retreat to its home bases. That was the last seen of any German warship in the North Sea. . . . After their Zeppelins had reported the presence of great British forces they devoted all their abilities to escape meeting with the Fleet which they were boasting a few weeks ago they had smashed."

A German Opinion of the Intrepidity of British Aviators is contained in a recent issue of the *Neueste Nachrichten* of Kiel, in the form of a description of the Allies' air service by a Rhinelander. "The gigantic number of enemy aviators," states our German contemporary, "exceeded anything seen or experienced in this war. By 3:30 A.M. they were already flying, and they cruised with the greatest coolness in the midst of our fire. They fly so low that we can make out the smallest details with the naked eye. Their aviators carry out peace-time maneuvers, and are indifferent to all dangers. They even shoot at us in our holes and trenches with machine guns, and when they want to find our bomb-proofs they come down still lower until actually within pistol-shot. Many of them have been shot down, and when their photographs have been developed we have been able to distinguish the entrances to our shelters. Their artillery has much to thank them for. As a rule young English lads of from 18 to 20 years of age—quite little fellows—sit in the French machines. When they threw down that wreath for poor Immelmann they did it right over one of our batteries. Then they were off again; and five minutes later that battery was under such fire that it had to change position mighty quick. They are frightfully cheeky, these aviators, and as they usually fly six together it makes no difference if one or the other is lost."

Science

Public Health in Siam.—The American vice-consul at Bangkok reports that much interest is displayed by the Siamese government in perfecting medical and sanitary arrangements. Bangkok, the capital, now has up-to-date waterworks, equipped with an American system of sand filters. Two large and well-equipped government hospitals have been opened within the last two years.

A Hydrobiological Station in the Alps.—Switzerland's first hydrobiological station has recently been established at Davos, the well-known high altitude health resort in the Alps, with the financial support of the local government and under the direction of the Kurverein. It will be used provisionally in connection with a botanical and zoölogical survey of the Lake of Davos that has been in progress for the past year. Another station of this character is about to be established on the shore of Lake Lucerne.

Controlling Sex in Animals.—In a recent publication by A. Morosini, of the Royal University of Palermo, the writer describes a method of controlling sex in the breeding of animals in which he has attempted to apply a combination of factors heretofore applied separately in such experiments. He claims that he has thus been able to obtain for a long series of generations of different pairs of animals litters exclusively unisexual; first all males and then all females from the same parents. His method is now being applied to the breeding of sheep, asses and cows at the Agricultural Institute of Castelnuovo and at the Royal Zoötechnical Institute of Luparello (Palermo).

Classification of Hydrometeors.—There is no language in which the terminology of the hydrometeors (the atmospheric phenomena resulting from the condensation of water vapor) is not more or less confused and incomplete. Attention has recently been called to the extraordinary confusion in the use of the word "sleet" prevalent in this country, but many other examples might be cited to show the need of a more scientific classification of the aqueous meteors than has heretofore existed. Such a classification has recently been attempted by Dr. G. Hellmann, director of the Prussian Meteorological Institute, and an English translation of Hellmann's paper has been published by Dr. C. Abbe, Jr., in the *Monthly Weather Review.*

Lost Russian Polar Expeditions.—The Russian government has announced to the government of Canada that no news has been heard of two Arctic exploring expeditions which sailed in the summer of 1912. One of these, under Russanov, left Spitsbergen in the motorboat "Hercules," bound for Nova Zembla. A larger expedition, under Lieut. George Brussilov, set out with ambitious plans for making the Northeast Passage and also carrying out detailed explorations along the Siberian coast. The last news of this expedition was that eleven members of the party had left the ship in the Kara Sea, and after nine of the number had perished the surviving two were picked up by the expedition under Lieut. Sedov. Brussilov, with the rest of the party, was reported in the summer of 1914 to be still with his ship, hoping to drift westward north of Spitsbergen, and return thence to civilization.

Statistics of Air Pollution.—A movement in behalf of the systematic investigation of atmospheric pollution in Great Britain began with a conference of delegates of municipal authorities and others held in connection with the Smoke Abatement Exhibition in 1912. A committee was appointed at that time to undertake regular observations. This body adopted a standard form of "pollution gauge" (often referred to as a "soot gauge," but this name is inadequate as the gauge measures other forms of atmospheric impurity besides soot). The gauge receives and retains the rainfall of an entire month, and this is eventually removed, filtered and analyzed. The amounts of tar, carbonaceous matter other than tar, insoluble ash, soluble matters, sulphates, chlorine and ammonia are separately determined, and the values are reduced to metric tons per square kilometer. The first report of the committee, published some months ago as a supplement to the *Lancet*, contains detailed statistics for 39 stations for various periods of time, and town maps showing the location of all the gauges, of which there are 8 in London and 11 in Manchester. Of total solids, found in rainfall the greatest amount was deposited at Oldham; viz., 35 tons per square kilometer per month. Ancoats Hospital, Manchester, came next, with 27 tons. The smallest deposit was at Malvern; viz., 2 tons per square kilometer per month. If the records of these 39 stations represent the average condition of the air as breathed by the British population, it may be stated that the average atmosphere deposits upon a square kilometer in any one winter months 15 tons of solid matter, made up of 0.15 ton of tarry matter, 3 tons of other carbonaceous substances, 6 tons of insoluble inorganic dust, besides soluble salts, which include 3 tons of sulphuric acid, a ton of chlorine, and 0.3 ton of ammonia.

Radio Communication

French Control of Mercantile Wireless.—It is announced that the French Marine Commission has appointed nine commissioners, who, with the delegates of the French Navy, will control the installation of wireless telegraphy and armament on mercantile ships and the rules for the navigation of such ships.

Wireless in the Far North.— It is stated that a harbor is being constructed and a wireless telegraph station is being built in connection with the State coal mining operations which have been commenced in the newly-discovered mines on Bjeerneoen (Bear Island), between Spitsbergen and the northern point of Norway.

Detector in Wireless Telegraphy.— Mr. W. D. Bancroft, writing recently in the *Journal of Physical Chemistry*, discusses the mechanism by which the electrolytic detectors, crystal rectifiers and coherers are operated, and expresses the opinion that the fundamental feature in all three cases is an absorbed gas film on the surface. The action of the three detectors when subject to waves is due to the fact that electrical stress decreases the thickness of the absorbed gas film, and, therefore, decreases its resistance.

Among Dr. Lee DeForest's Latest Apparatus is a one quarter kw. oscillion or oscillating valve transmitter. As the wave generator the set employs a large audion bulb the filament of which requires 30 volts, while the high tension circuit calls for a current of 800 volts. The latter is supplied by means of a small motor-generator. A small fan is employed for the purpose of cooling the audion bulb. While the set is primarily intended for undamped wireless telegraphy, it may be used for wireless telephony by the addition of a microphone transmitter, one or two dry cells, and a telephone transformer.

Unique Variable Condenser.—There has been introduced by Eugene T. Turney, an inventor of New York city, a variable condenser of ingenious and most practical design. Essentially, the condenser consists of two semi-circular cones, one within the other. The inner or movable cone is accurately mounted and can be raised or lowered by turning an upper rubber knob, which varies the air space between the cones and hence changes the capacity. The same cone can be turned by a horizontal lever, so as to alter the extent to which it meshes with the fixed or outer cone, which is indicated by a pointer traveling over a graduated scale. Seven different capacities are gained by varying the position of the movable cone with respect to the fixed member, as indicated on a fan-shaped scale; while the semi-circular indicator shows the variable capacity of each of the seven steps.

New Rates for Alaskan Radio Service.— The Director of Naval Communication has announced that, effective, October 1st, 1916, radio rates, to conform as near as possible to the rates of the Washington-Alaska Military Cable and Telegraph system effective that date, will be placed in effect via the Naval Communication Service in Alaska. All traffic to or from ships at sea will be prefixed "Radio." Cable count will be used. Ten-word minimum will be required. Naval radio stations at St. Paul, St. George, Dutch Harbor, Kodiak, Cordova and Sitka will apply a 6-cent coast tax. Service between any point in Alaska reached by the Naval Communication Service or the Washington-Alaska Military Cable and Telegraph system and any of these stations will carry a rate of 5 cents per word additional. This will also include North Head or Seattle for local delivery or for transfer to other systems to reach points beyond these systems. The traffic may be routed via either the Naval Communication Service or cable service or both. This rate does not include other line charges, which should be added if it is necessary to employ other lines to reach destination.

An Improved Wireless Transformer.— For the use of small wireless stations there has of late been put on the market a new type of transformer, offered in sizes of ¼, ½, ¾ and 1 kilowatt. One of the advantages of the new transformer is that all castings have been eliminated, the framework being built of formed sheet steel and brass. Not only is the construction thus rendered unbreakable, but the weight is reduced nearly 20 per cent. The use of smaller cross-section steel results in a reduction of the eddy currents in the frame, and hence a higher efficiency. Mounted on the upper yoke of the magnetic circuit is the one circular coil that forms the secondary. It is wound in layers with special insulating paper between each. The transformer has an external magnetic shunt, and the intensity of its magnetic field is varied by means of a V-shaped laminated steel tongue moving in the air gap so as to vary the width of the gap. The variation is accomplished by the use of two gear wheels that grip on each side of the tongue. On the gear shaft is placed a cam that readily locks the tongue in any position and eliminates practically all noise that would arise from a loose tongue.

Testing a Diamond

Many Ways of Separating the True and the False

By S. Leonard Bastin

FROM time to time various tests have been indicated by means of which the genuine diamond may be distinguished from the false article. In order to make absolutely sure in this very important matter it is a good plan to subject the suspected gem to as many of the experiments as may be convenient. This is more especially to be recommended on account of the fact that, now and again, so-called diamonds may actually be cut from stones of one sort or another. In certain cases these stones may answer in a moderately satisfactory way one or two of the tests. But as we proceed from one experiment to another the true character of the articles is soon indicated.

One of the oldest tests for a diamond is of course the practice of drawing it over a sheet of glass. The popular idea that a paste article will not make any mark is incorrect. Well-made imitation diamonds commonly scratch glass, but they do not cut it. A real diamond drawn quite lightly over the surface cuts the glass so completely that the slightest blow will cause a separation. Another old test is that in which a file is employed. In the case of a real stone it is impossible to make any impression with the implement. An imitation article is easily marked. Or the suspected gem may be placed between two coins and pressed hard with the fingers as shown in the photograph. It will be impossible to make the smallest impression on a real diamond, but, in the case of a paste article, the edges may be crushed. The effect can be discerned by a critical examination with a lens.

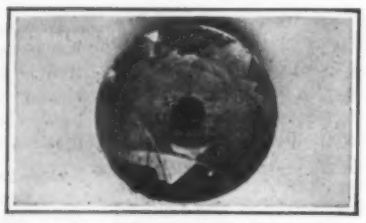
When a diamond is quite clean and dry carry out the following experiment. Place on the surface a tiny drop of water. Now take a needle or pin and try to move the drop about. If the diamond is genuine the drop can be rolled about intact. On the other hand where the gem is an imitation the water spreads directly it is touched with the needle-point.

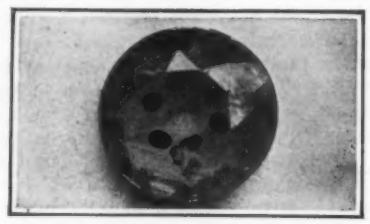
Another very good test may be carried out with a tumbler of water. Into this put the suspected article and examine its appearance. A real diamond will show up in the water with a startling clearness and it can never be confounded with the water. On the other hand the imitation looks indefinite and it is sometimes difficult to see it clearly at all.

Make a single black spot on a white card and hold the diamond in front of this at a distance of about a quarter of an inch. If the gem is real the spot stands up quite plainly. On the other hand in the case of a spurious gem a ring of spots is usually seen and these are often blurred. Select a piece of any fabric with red and white stripes on it. Now draw the stone, which is being tested, over the colors. With an imitation the colors will be plainly seen, while with a genuine diamond it is not possible to see the tints.

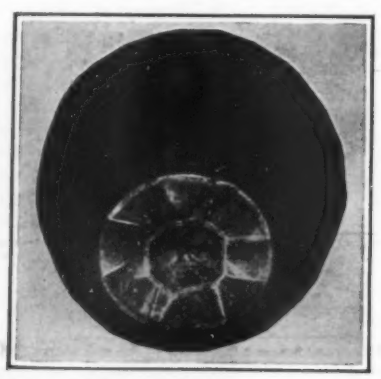
Generally speaking the facets in a real diamond are not cut so truly as those in the imitation. This is on account of the fact that diamonds are sold by weight; hence the cutter tries to preserve as much of the original as possible, even making small sacrifices in the matter of regularity. In the case of a paste article or a cheaper stone no such need arises and the cutter endeavors to make the stone appear as perfect in shape as possible. To observe such irregularities as sometimes occur in a real diamond it is needful to examine it with great care.

Many diamond experts are able to tell a false from a real gem by simply touching the article with the tip of the tongue. It is said that a genuine diamond always feels noticeably colder than a paste article.





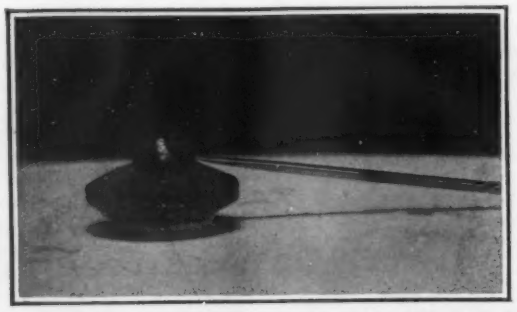
A single black spot viewed through a genuine (left) and a false (right) diamond



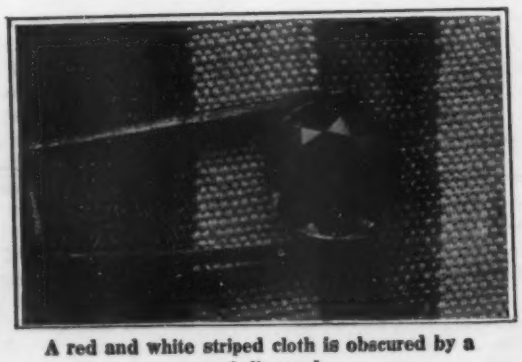
A false diamond (left) is seen indistinctly through the fluid; the true stone (right), when submerged, stands out clearly

The edge of a real diamond cannot be crushed between two coins

Placing a diamond in a glass of water to test its genuineness



A drop of water can be moved about intact on a good stone



A red and white striped cloth is obscured by a real diamond

The test with an aluminum pencil is worth trying, as this is commonly regarded by experts as the surest of all. Marks on glass, or any similar substance containing silex, made with an aluminum pencil cannot be removed no matter how hard they may be rubbed. Even with the use of acids it is difficult to erase them entirely. Wipe a suspected stone carefully and then mark it with an aluminum pencil. Now rub briskly with a moistened cloth. If the gem is real the mark will disappear at once. Where the line remains it is certain that the stone is not real.

Finally real diamonds are phosphorescent after being treated in the following manner. First of all expose for a few minutes to the light of an electric arc lamp. Then rub briskly on wood or metal. Now take into a dark place when the diamond will glow brightly. This does not occur in the case of a false gem.

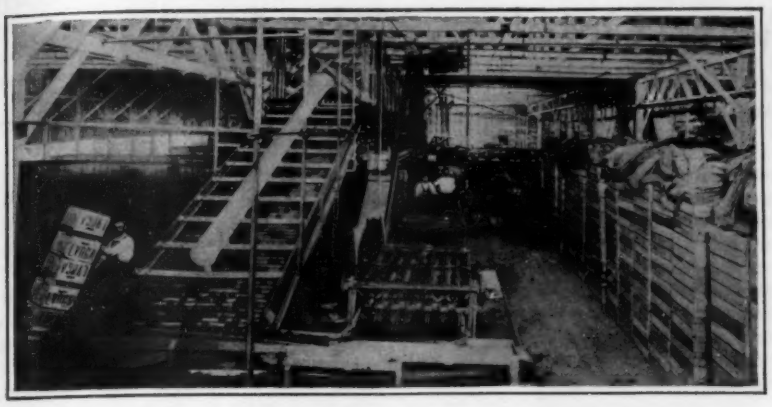
The Current Supplement

IT is not generally realized that the campaign that Italy is conducting against the Central Powers, on her mountainous borders, is in many respects the most spectacular and sensational ever recorded. A short note in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2130, October 28, accompanied by photographs, calls attention to this condition of affairs, but unfortunately reports from this region are scanty, owing to the diversion of attention to the other war sectors. An article of importance is *Latent Life*, by Paul Becquerel, which discusses its nature and relations to certain theories of contemporary biology. *An Electro-Chemical Action on Glass* describes an unusual action that appears not to have been heretofore described. It is accompanied by several illustrations. The paper on *New Archaeological Lights* is concluded. *The Enlisted Man in the U. S. Navy* tells something about the opportunities offered in our navy, and is illustrated by several excellent photographs. *Thermometer Scales* calls attention to a matter of considerable scientific importance, and gives comparative diagrams of the Fahrenheit, Centigrade and Absolute scales, together with important temperature records. *Speech, Its Culture and Refinement* calls attention to a feature that appears to have been entirely overlooked in our educational system. *A Morse Optical Pyrometer* describes the construction, and some of its numerous applications in the laboratory. It is accompanied by illustrations. *The Passing of the Acid-Bessemer Steel* tells something of the career of this important material, and how it is being supplanted by other processes. *Powdered Coal as a Fuel* treats of a method of using our fuel supplies to greater advantage than at present, to which attention is directed by the necessity for economy and increased efficiency. There are the usual shorter articles and notes.

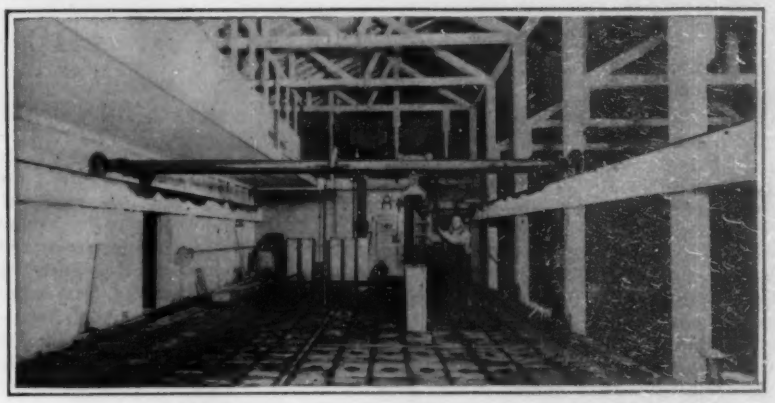
Rural Concrete Contracts

RURAL contractors specializing in concrete work, especially those building silos and other farm structures, also contractors or others who would like to specialize on such work, will be interested in knowing of a coöperative plan now being carried out by the Extension Division of the Portland Cement Association.

Any one interested in concrete contracting work or in taking up such work, is invited to address the Director, Extension Division, Portland Cement Association, 111 West Washington Street, Chicago, for some information that will prove valuable, and that can be obtained without cost or other obligation.



An orange washer and section of drier used in one of the California regular packing plants



The ice tank room in an orange packing plant. This equipment has a capacity of 30 tons daily

Pre-Cooling California Oranges to Save Millions of Dollars Annually

By Victor W. Killick

ORANGES are not, as a rule, classed as a perishable fruit. After being picked from the trees they may be kept a prolonged time in a proper temperature under the right atmospheric humidity. But fluctuations in temperature and humidity cause them to deteriorate very rapidly and to become unsalable in a remarkably short time.

This has been one of the biggest problems of the California citrus growers. It usually takes from 10 to 12 days for the California fruit to reach the eastern markets after it is picked. During this time it is subjected to temperatures varying from the semi-tropic desert heat to the piercing cold of the snow-capped mountain summits, and undergoes atmospheric changes of extreme range.

Various plans have been devised to control this situation. The system most extensively tried has been that of shipping fruit in refrigerated cars. This method, though not entirely adequate, has proved a big saving to the orange men, so much so, in fact, that they now consider it greatly worth while to invest heavily in a still better and more elaborate method of protecting their fruit during transit—that of effectively pre-cooling it.

Pre-cooling is a process of reducing the temperature in all parts of an orange before shipment and then maintaining a sufficiently low temperature about the fruit by refrigeration until it reaches the market. Pre-cooling requires costly apparatus and specially constructed buildings; but it is saving a million dollars annually to the California orange growers at the present time, and bringing ten per cent more western oranges into the east in salable condition than heretofore.

Preliminary to the pre-cooling process, the oranges are picked in the groves with gloved hands to prevent the slightest abrasions on the skin, which foster fungus growths quickly. Then it is hauled to the packing house. Here the fruit is first washed between revolving brushes in a solution of warm water in which a small quantity of lye is mixed. From the washer the oranges are rolled forward on ball-bearing, roller conveyors to the drier.

The drier consists of a roller conveyor that carries the wet fruit up an incline and immediately under a system of large pipes from which a continual stream of dry air is forced through tiny jets upon the slow-moving and revolving oranges. The driers run from 50 to 100 feet in length and by the time the fruit passes through it to reach the size-grader, it is always dry.

The grader sorts the sizes. The fruit is then completely wrapped in tissue paper and neatly packed in boxes for shipment by women in the usual manner. It is then placed upon roller conveyofs which carry it to the pre-cooling room.

This is a large, air-tight compartment having a storage capacity of one or more car loads. Cold air is forced in from one end through a trap vent at the top of the wall. This descends upon and passes through the boxes of the stored fruit to the opposite end of the room, where the warm air is taken off through another trap vent. It takes about 40 hours by this process to reduce every orange in the entire shipment to a temperature of 35 deg. The precise temperature is determined by selecting a box somewhere near the center of the room and thrusting the pointed bulb of a thermometer into an orange near the very center of the pack and another thermometer in an orange near the outer edge.

Receiving and discharging conveyors in an orange pre-cooling plant

After pre-cooling, the packed oranges are next conveyed either by hand trucks or roller conveyors to the refrigerator cars, which have previously been iced with from 10 to 15 tons of ice, according to size. In bringing the fruit out of the pre-cooling room the transit is made through canvas-covered tunnels the entire way to the car door, and great care is exercised to keep all warm air from getting to the fruit.

A number of the California orange associations are expending as much as $50,000 in building pre-cooling plants in connection with their regular packing establishments. Some of them have their own ice-making plants ranging from 10 to 30 tons daily capacity. In connection with these, concrete ice-storage buildings are usually constructed, of sufficient capacity so that when filled at the beginning of the season they will carry the plant through its rush times when the daily output of the ice manufacturing equipment would be too small.

The matter of loading the railroad cars with fruit and ice is facilitated by building two decks on the side of the building abutting upon the spur tracks. The lower of these decks is made on a level with the floor of the car and the fruit from the pre-cooling rooms is brought to this level. The upper deck is made on a level with the tops of the cars. Along this deck big blocks of ice are conveyed either from the manufacturing plant or the ice storage house and dumped directly into the bunkers of the cars.

Other ideas of pre-cooling have been tried. In one of the systems an arrangement was constructed to pass the fruit through cold air, keeping it moving continuously from the time it was packed until placed in the cars. Partly freezing the fruit in an iced brine has also been tried. However, it appears that these other systems have not been adopted to any large extent, while six of the largest southern California packing houses have appropriated big sums for pre-cooling plants embodying the general scheme here described, and ten more are contemplating so doing.

Loading Iron by Magnets

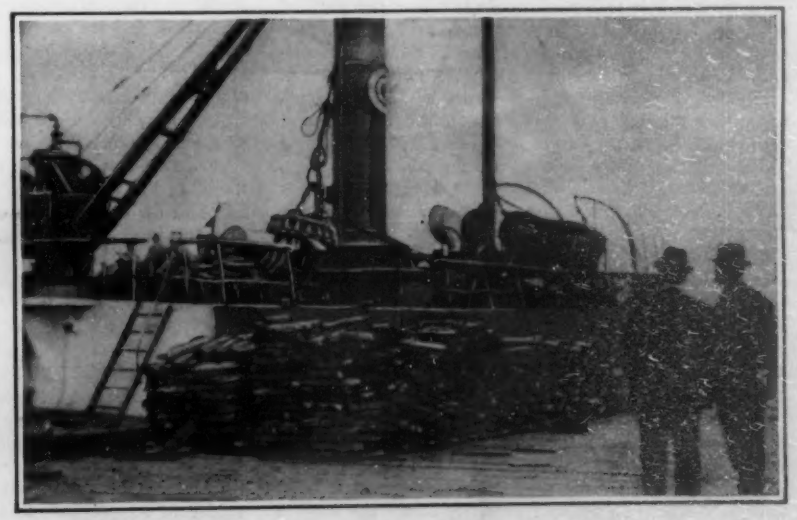
By F. C. Perkins

THE successful and economical use of magnets for unloading cargoes of ore, pig metal, etc., has suggested to a Lakes shipping house that the same means might profitably be employed for the loading, which has always heretofore been accomplished by gangs of longshoremen. Accordingly, the apparatus we illustrate has been installed on a Lake Michigan freighter.

The big circular magnets, of which our illustration shows one, are 3 feet in diameter, and are attached to the crane just as is the ordinary block and tackle. They swing out over the dock from the crane, and as they near the pile of iron pigs, the latter fairly leap to the magnet and are carried away, to be dropped into the hold of the ship when the operator turns off the current. The boat's crew then stow the pigs away.

The total cost of putting on board by this means a cargo of 2,000 tons of pig iron was $100. The cost of loading with longshoremen would have been from $500 to $600. The installation consists of three units; and with all three working together, 4,500 pounds net weight of iron can be lifted from the dock at once.

Close view of magnet in operation. Note how the pigs fly up to it



Taking on cargo of pig iron by means of electric lifting magnets

Strategic Moves of the War, October 20th, 1916

By Our Military Expert

IT is extremely hard to get a true perspective on the great European war. This conclusion is not advanced as a great discovery; merely as a realization that actual conditions to-day impose upon one's understanding. It cannot be that arithmetic is at fault, for when all the factors of a problem are given their proper valuation and disposition, and when the process of their application is correct, figures cannot be made to lie. It is therefore evident that in our former estimate of the situation existing abroad to-day, some factor has been omitted or incorrectly placed; for without a shadow of a doubt the Entente possess potential manpower at least twice as strong as that at the disposal of the Central Empires, and according to all seeming laws of probabilities, a break should have been made ere now in some one of the Teutonic fronts.

But such a break has not been made as yet, nor does there now seem to be any in immediate prospect. This brings us back to the search for the omitted or underestimated factor. The most logical solution which presents itself is that even yet the magnitude and comprehensive scope of the Teutonic ORGANIZATION has not reached its full effectiveness and, though hard pressed numerically, this acknowledgedly great, still underestimated organization, is coping in masterful fashion with the array of arms before it. Germany, technically, actually, tactically, strategically, is putting up the most magnificent fight the world has ever dreamed of; such a fight that the Teutonic unwillingness to bow before the massing of men and arms which confronts it is better understood with the passing of each day because Teutonic unity of thought, determination and refinement of method is so complete that it recognizes its advantage over its opponents through these very things and from this unity, hope springs eternal that in the end—in the event that mankind may tire of human slaughter, perhaps—or in the event that superlative military genius may lead the hosts of the kaisers to tactical victory—the Central Empires will emerge triumphant despite appalling discrepancies in numbers. Regardless of inclination toward either side, one is compelled to accord Germany—for the organization is hers—an ungrudging respect for her wonderful achievements in this horrible and seemingly unnecessary war.

The discrepancy in numbers between the two contenders cannot be gainsaid. Statistics are too exact to be doubted, too accessible to anyone interested to be trifled with. The total maximum manpower of Teutonia was about 14,000,000; The Entente, leaving Japan out of the count, could muster over 28,000,000 men. Then why has not this two-to-one advantage counted so far, save by prevention from defeat to the Entente?

In round numbers the mileage of the battlefronts is about as follows:

France, 480; Russia, 900; Italy, 200; Roumania, 600; Macedonia, 170; Asia Minor, 1,000—a total of 3,350 miles. Leaving Asia out of the computation, for the front there is not as strongly held in general as elsewhere, there are 2,350 miles of intense battlefront to be considered.

In general it is safe to estimate two men per yard of front as the minimum efficient force. Roughly, this comes to 3,500 men per mile of front. Basing the estimate on this, 8,225,000 soldiers actually hold these lines, exclusive of general reserves—uncalled classes, etc., and munition and supply workers. And this number represents the battle line of only one side. The enemy has an equal number—a total of men confronting each other amounting to sixteen and one-half millions, which is practically the force that has been afield since the war got well under way.

The consensus of opinion of foreign observers and actuaries is that each force afield loses about 6 per cent per month, about equally divided between (1) Wounded and (2) Killed and Captured. At least 60 per cent of the wounded, probably more, are later returnable for duty. To roughly estimate the permanent losses, therefore, let us assume the percentage of total incapacitation as .04 per month; 48 per cent a year, 96 per cent for two years of war. Each side, with 8,225,000 men afield, would in that time have lost nearly eight million men, permanently. There is a slow growth of youth to manhood which can be utilized partially to fill the gaps, a military coming of age which, in the case of Teutonia, should leave at the present time full strength on the line—as full as ever—but by the same inexorability of cold mathematics, Teutonia now should be confronted by an alarming scarcity of all important reserves; eight million total losses in twenty-six and a half months of war deducted from a potential military population of fourteen millions, fifteen—sixteen, say, leave but a trifle more than eight million men now available, even including the addition of growing young men.

On the other hand, assuming that losses have been equal—as approximately they have been—the loss of eight million men to the Entente leaves twenty millions available now; and if the proportion is carried farther, theoretically in another twenty-six months of war, Teutonia will have but a quarter of a million men in the field while the Entente, having lost an additional eight million, sixteen million in all, will have eight million more on the line, with a reserve of four milion untouched.

In other words, the time is now at hand when Teutonia must conserve her man-power, for there are no others upon which to draw. As the gruelling four per cent loss per month continues, the lines must either be weakened numerically, or must be contracted until a lesser total than 8,225,000 is required to man them. It is the law of attrition.

General map of the European battle fronts

In the meantime, though, Teutonia is on the line in full strength, unweakened except in reserve power. The lines in France, Russia, Austro-Italy and the Balkans have not been broken yet by the fiercest assaults, equal in intensity to those hurled by the Germans upon the defenses of Verdun. And with the introduction of Roumania into the struggle Germany, with her sound military policy, has not waited for attack, but has assumed the tactical offensive which is strategic defense, pushed up into the unprotected Dobrudja and organized against the Roumanian flank attack against Austria-Hungary while preparing the shorter lines of defense diagonally across Transylvania.

It is time to answer our own question. The reason why the Entente preponderance of numbers over Teutonia's numbers has had no effect so far seems to be found in the fact that until now Germany (Teutonia) has had all the men she could use on the line, on the principle that only a given number of men can occupy a given space, the extent of the lines; the lines on every front have burrowed into the earth, in successive trenchments, where it is well-nigh impossible for an attacker to oust a defender; and for the last few months the supply of *materiele* has been of about equal magnitude and efficiency, with little to choose on either side.

Perhaps we have left something important out of the calculation; perhaps one or more elements of the premise may be wrong; perhaps, after all, an omniscient God may choose to bare His arm for the overthrowing of mortal tables of potential strength, and cancel the ledger of supportable losses. Then these figures will have lied. But if the actuaries have been humanly correct, Teutonia seems slated from about now, on, to waning strength, with one of the two above mentioned situations to meet—to hold her lines in lessened strength, or to shorten her lines. The first courts imminent defeat; the second promises continued bloodshed, while the clock of Time ticks out its grim count of comparative millions—"Twenty-eight—Fourteen—Twenty-eight—Fourteen."

The war? Frankly, we had forgotten its details. The situation seems about the same as that for the past two weeks. Germany, Austria, Bulgaria are all holding, making bold thrusts here and there, yet fighting a defensive way. The Entente is pounding along the Somme, along the Carso, in the Balkans and on the lower Rusisan front. Winter is near, about to settle down for another period of cold and suffering along the trenches, unless an unexpected break should occur somewhere before that time. But another winter in the field cannot harm the prospects of the more powerful contender; it can only impose more hardships upon all concerned—but it cannot build men to fill depleted reserves.

For magnificent daring, determination, ability, organization and faith in their right to dominate, one must duly applaud, in all sincerity, those Teutonic soldiers who *must* know by now that they are fighting against inevitable odds; for sheer weight of numbers and resources the loosely organized martial federation of the Entente must give thanks that they have not been overwhelmed. Discussion of political right or wrong of one side or another has no place here, whatever beliefs may be entertained; the writer merely holds the conviction that in the end numbers cannot be denied, and has set it forth for what it may be worth.

A Correction

OWING to a typographical error the caption under the line drawings of the article entitled "The Privately Owned Naval Scout," appearing on page 363 of the October 21st issue of the SCIENTIFIC AMERICAN, read incorrectly and as a consequence may have given rise to some confusion. It should have read: "Plan view of 66-foot scout and side elevation of the 45-foot Naval scout."

Some "Rebuilt" Auto Fakes

MANY dozens of places are now operating second-hand motor car businesses, and while some of them are quite reliable, it is still a sad fact that "faking" cars is a common occurrence.

One purchaser of a so-called rebuilt car in New York paid $200 for a machine which is no longer built. It was guaranteed to be in running order, and worked fairly well on the way home, a distance of 10 miles. The following morning he was unable to crank the car, and upon removing the cylinders he discovered a very unique hard wood piston in the front cylinder. The car being out of date, the dealer had been unable to obtain a piston for it, and had improvised one. The oil and heat of the cylinder combined to warp the wood and make the motor stick. The wood had evidently been treated with some heat-resisting compound, as the charring on the surface which had been exposed to the heat of combustion was not severe.

In another case, a purchaser of a second-hand runabout detected a most peculiar noise in his timing gears, which in that model were mounted on the front of the engine. Removal of the gear case revealed the fact that the gears had been packed in heavy grease in which was mixed chopped cork and sawdust. The bearings of the gears were badly worn and the imperfect meshing which resulted made them very noisy. The cork and sawdust effected a temporary remedy.

A third purchaser of the "running order" gamble found that after he had driven his car a dozen miles, three leaks developed in the cylinder casting. In the pan he found three pieces of dried chewing gum that exactly fitted the holes.

Among some of the other features of such "bargains" are cast iron ball bearings, papier-maché radiator hose covered with aluminum paint, steel breaker points in magneto instead of platinum, window glass in window shield, and cracks in crank case filled with putty painted over. In view of all this, who can wonder what has become of the good old-fashioned horse trader?

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Question of Warship Design

To the Editor of the SCIENTIFIC AMERICAN:

Accept of my most hearty approval for your standpoint on the matter of the types of ships that are at the present time most needed for the United States Navy; it is the one question that is on our minds at all times. While I am forced to take issue with you on the question as to the size of submarines that is best suited to the needs of the Navy; and I have served in—or with—four different types—the "C," "D," "E" and "K," and have some small ideas as to the others; I am forced to the conclusion that the two classes that are needed for our Navy, are: Coast Defence and Fleet. And for the first I am of the opinion that our classes "K," "L" and "N" are better adapted than a larger size of craft would be. The reasons for this opinion I am not at liberty to give. But it seems that the same opinion is held by many of the officers that have served in submarines. The fleet submarines should be large enough to cruise without a tender, that is, should be of such a size that the crew can live in them to the same extent that they live in the torpedo boats. The article by Mr. M. K. Barnett, in the issue of October 7th on the battle cruiser, is entirely to the point. The article in Correspondence, in that issue, by W. F. Johnston, seems to me to have been written by some one that was rather less than "half naval expert," and to have missed the point entirely. I am not one who is paid to design the ships for the United States Navy, but I have served in the Navy for over 20 years and have kept as close track of the ships that we had, and the ships of "any possible opponent," as it was posible for a man to do without having access to confidential reports. The same reasons that make the type of "exceptionally fast, and heavily armed—but lightly armored" ships that we now call battle cruiser, logical for the English, German, Russian and Japanese navies, makes ships of that type logical for our Navy. And the fact that almost any possible opponent has ships of that type makes it one of the most important classes of ships for *us* to have. If Mr. Johnston had any conception of "naval strategy" he would readily see where the need of them was. The article by Mr. Barnett covers that so fully that I need not but refer to it. As to the number of guns that our new battleships should carry; that is a question that I prefer to leave to the officers that are charged with the design of our ships. And as to the matter of what guns the new scout cruisers should carry; it is a matter of surprise to me that Mr. Johnston did not think that they also should carry 16-inch, at least two, which at this time would be a much more logical battery than six 10-inch, and would call for about the same weight. I have seen the ideal of our battleships change from the "Oregon" of 10,200 tons and 15 knots, to the "Arizona" of 32,000 tons and about 21 knots. The "Arizona" would be far more than a match for *four* of the "Oregon" class, but I can recall that many men thought that the slow "Oregon" was better than a faster, if lighter armed, "Ohio," and saw no reason for the higher speed of the "Delaware" when that ship was first called for. The men in the United States Navy are satisfied to leave the design of our war ships to the officers who have specialized in that line of work, and we will do our best to give a good account of them, when the day comes that the Navy must stand between our country and *any enemy*, but we have little time for volunteer experts.

NAVY—(Gun Deck Section).

The Steam Car?

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of September 9 I read with great interest Mr. Prior's article favoring the steam car, stating it had solved the big question of the day for automobilists, simplicity and economy in operating a machine. I do not own a steamer, but Fate ordains that there should be one in the family whence comes my knowledge on the subject. In regard to Mr. Prior's first point, simplicity, to me the only connection the word has with a steamer is simply to leave it alone. If there is any gas car more complicated, and mysterious than a steamer I have yet to see it. To be really eligible for driving a steamer one should take an engineer's training. One has to keep a vigilant eye on the various dials of steam, pressure, etc., that keep company with several valves on the dashboard, to say nothing of pump valves located within reaching distance of the driver. These are only a few of the many simplicities that demand the constant attention of the careful driver, and help to pile up trial and tribulation for the owner of a steam car.

Next, the important subject of economy. Yes, kerosene is cheaper, selling for about nine cents a gallon, as compared with twenty-four for gasoline, but some things are worth the price. Perhaps Mr. Prior has been in one of the big stores in New York equipped with a restaurant where one may eat on the lower floor, closely connected with the kitchen, and for a moderate price not only can obtain food, but be entitled to all the savory and unsavory odors thrown in, including the aroma of grease, fish, stews, etc. And also for a little higher price one may have the privilege of dining on the top floor, far away from these appetizing smells, where one may masticate to the strains of music and aid digestion by the beautiful view of New York's sky line. For one not born and bred in a soap factory there is but one choice. Some things are worth paying for, and gasoline as compared with kerosene and its results is one of them.

There is an everlasting odor, going, coming or standing, in the car that uses kerosene for fuel. Kerosene never will be popular or practical so long as it is accompanied by that penetrating and disagreeable odor, which takes us back to the days of smoking lamps. After a day's ride, the car, the passengers and in fact the whole outfit reeks with attar of kerosene, which can be purchased at any country store for nine cents a gallon.

Users of steam cars are getting less each year instead of more, and it is only a question of time when the old steamer will be as scarce as the deacon's one-horse shay.

A RIDER IN A STEAM CAR.

How the Giant Destroys

By C. H. Claudy

AT Gettysburg a sharpshooter built himself a little wall between immense boulders in the Devil's Den. He was found dead behind his wall with no wound upon his body.

In the battlefields of Europe many men die without a wound. Natural attitudes show they died instantly. The only theory which fits the facts is that they die from what kills the worker in compressed air—the dread caisson disease or "the bends."

Bubbles froth to the top of an uncorked champagne bottle. In a soda siphon are no visible bubbles, but many are in the liquid which squirts from it. Sudden release of pressure draws gas from a liquid.

It is supposed that tremendous pressure from violent explosion and its sudden release causes bubbles of air to form in the blood of the men who die without a wound. In "the bends" these are allowed to escape slowly (and painfully) while pressure is gradually reduced. The man lives. If pressure is suddenly reduced the bubbles are large enough to stop the heart beating. The man dies. On the battlefield there is nothing to soften the sudden increase and decrease of pressure. A man died at Gettysburg in a situation between huge rocks which might easily have allowed the puny shells of '63 to create a sufficient pressure to make him kin to his dead soldier brother of 1916.

We read so much of shells and explosions and detonations and shrapnel and forty-two centimeter guns and "high" explosives that we pass them by as commonplaces—dread, perhaps, and fearful, but still, a matter of course in war. Yet—what *is* an explosion?

It is commonly supposed that explosion is but a rapid burning of a chemical compound. Sudden combustion may be explosion, but not all explosions are merely rapid combustion. Many explosives ignite and burn harmlessly which, hit with a hammer, will tear anything to pieces in the immediate vicinity. Gunpowder—which explodes by rapid combustion, is no longer even the prototype of explosive. So wonderful when first discovered, it is now a back number, out of date, a very pigmy, compared to some of its "high" relatives. Even its rate of burning is no more a marvel.

How fast a compound will "explode" is important. All explosives require confinement to be effective, just as a blow requires something solid to land upon to do damage. The most vicious uppercut will not hurt a chin in front of which there is a pillow. Similarly gunpowder, which, ineffective as it is, may yet be terribly destructive when set off in confinement, will go up in a harmless puff of smoke, if ignited in a little pile on the ground.

But a piece of dynamite on the ground will blow a hole in the earth. From this has come the absurd belief that dynamite explodes only downwards. Any explosive acts with equal force in all directions. Unconfined, slow burning gunpowder can push the air away fast enough to make room for its bulk of released gas, while dynamite changes from a solid to a gas so quickly that the inertia of the air is all the confinement it needs. Support a stick of dynamite on the under side of a plank resting across two logs and this will be shattered as fully as if it rested on the ground with dynamite on top.

Capping a charge of dynamite on an exposed surface with a handful of mud is a custom which some miners have found effective. They say, "It holds down the force." And when the dynamite has been slowed up in the factory by the admixture of some inert substance even so modest a confinement as a handful of mud, gives just the added inertia needed by the confining air to make the rending force most effective. The same thing can be observed if a heavy metal weight or stone is placed over a charge of gunpowder on the ground—there will be no doubt of the hole blown in the earth under such circumstances.

Not all explosives are burning compounds or mixtures. There is the peculiar and not thoroughly understood phenomenon of detonation. The most common detonator is fulminate of mercury. This small confined fiend from the Hades of Explosia is not used to do damage itself—for it has no great power to move weight or rend at a distance. With one or two exceptions, it is the most vicious of all the compounds which go off at a blow. Its use is to fire the explosive which does the damage. In its own field it is supreme—not only in setting the larger giant to his task, but in telling him how he shall do it. It makes much difference to some explosives whether they are fired with a fulminate, which shocks them into action or whether heat alone inspires them to work. Thus 15 grains of fulminate of mercury will start King Guncotton doing damage much more effectively than 70 times as much nitroglycerine.

The force of a detonator is enormous—but effective for but a short distance. Gunpowder will explode, and propagate its explosion at a rate of from two to three meters a second up to an outside limit of 300 meters a second under the most favorable conditions. The fulminates have a minimum propagation of about 8,000 meters a second. A meter is something over 3 feet. A sixty-mile an hour express train goes 88 feet a second. Imagine 24,000 feet a second and you will know why a very minute quantity of fulminate of mercury going off in your hand will carry a finger with it and yet not burn your coat.

The whole power of any explosion, whether it be a burning or a detonation—which is a sudden flying of certain chemicals into gas all at once, everywhere throughout the mass regardless of heat—is caused by Nature's total refusal to permit two bodies to occupy the same place at the same time. Gunpowder occupies a hole drilled in a rock deep enough to accommodate a pint. A fuse explodes it. During the time it takes that pint of gunpowder to change to a gas it grows, so that there are 401 pints of gas occupying the hole—or trying to. If the hole is strong enough, they might—but it isn't. They push the rock apart and make room for themselves. If it was a pint of good dynamite there would be a volume of 847 pints of gas trying to occupy that pint hole. And if it was blasting gelatine, 1,386 pints!

But the matter is not wholly one of two things in the same space at the same time, but how long the two are given to adjust themselves to the fact—which is that they *can't* occupy the same space at the same time! Here we come again to the rate of explosion.

The explosive tester calls it the relative kinetic energy. He expresses it in kilogram meters per second. One does not need to know the scientific meaning of the term to understand its significance. Gunpowder is rated as having a kinetic energy of 4,587. Picric acid, which is one of the giants of the explosive family owns to having a kinetic energy of nearly 3,500,000.

The last 20 years has seen a vast development of the "art" of making explosives. In our Civil War we knew gunpowder. In this war we have smokeless powder, gun cotton, dynamite, "high" explosives together. Modern war is so terrible because of man's ability to make substances which can kill at enormous distances, and which can wreck and ruin with the mere power of their resistless sweep, the shock of their passing. But a few years ago, if a piece of exploding shell didn't actually hit a man, it was harmless. The crater thrown up by Grant's gunpowder mine at Petersburg—a giant in its day—would be an ant-hole to the crater of *one* modern European shell.

So much have we progressed (!) in 50 years!

Production of Edible Beans in Manchuria

THE nonedible, oil-producing soya bean is the principal bean of commerce and export in the Mukden consular district of Manchuria, and is produced in large quantities. Edible beans are produced for home consumption. However, in normal crop years a surplus of edible beans is usually available for export after the home demand has been supplied. Reports indicate that this year's crop will be normal.

The principal edible beans are "hsiao-tou" and "lu-tou." The former consists of three varieties—red, which is considered of an excellent quality; white, which compares with the American navy bean; and one of mixed colors, red, white, black, and marble. The lu-tou, a green bean, is used principally in the manufacture of vermicelli and starch. The quantity of edible beans available for export from this district in the past few years has been roughly 7,000 to 10,000 tons per year. The hsiao-tou is exported chiefly to Japan, while the lu-tou is exported to China proper.

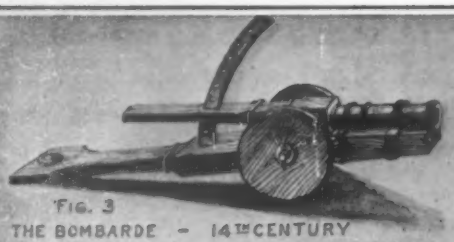


FIG. 3
THE BOMBARDE - 14TH CENTURY

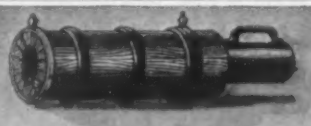


FIG. 10
PRIMATIVE CANNON OF 1554

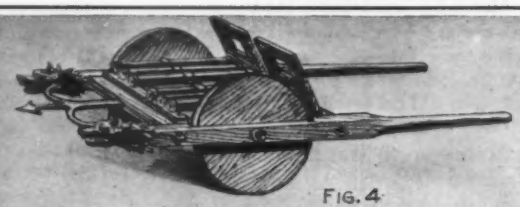


FIG. 4
ORGUE DE BOMBARDES
14TH CENTURY

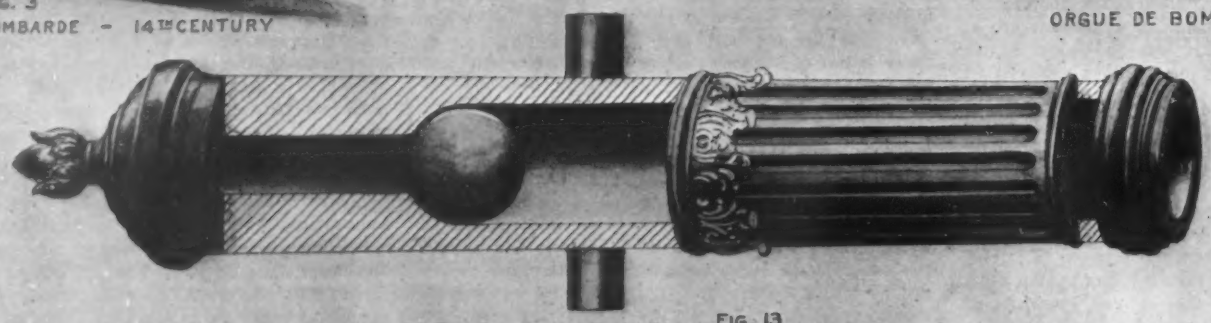


FIG. 13
EARLY 19TH CENTURY
CAST IRON CANNON

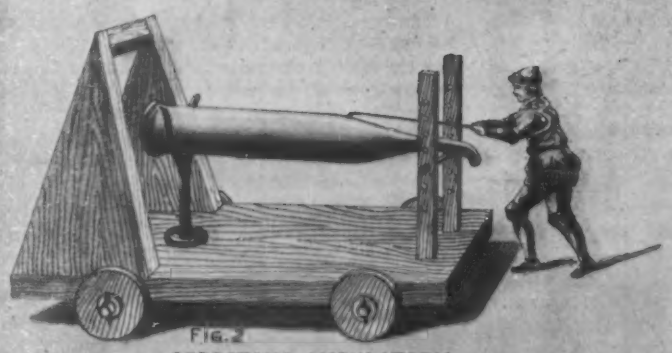


FIG. 2
CERBOTANA AMBULATORIA
14TH CENTURY

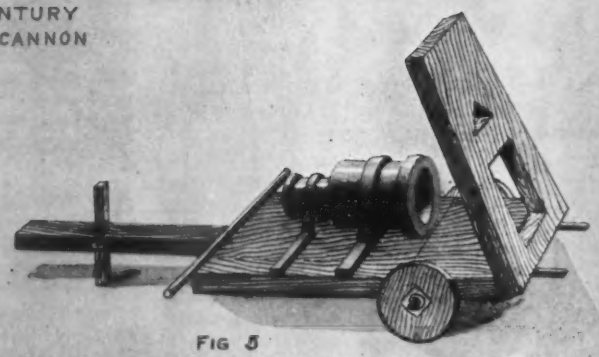
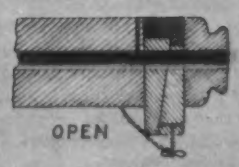
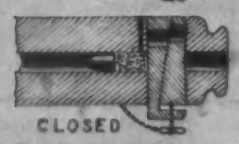


FIG 5
14TH CENTURY GUN WITH SHIELD

FIG. 6
ELBOWED BOMBARDE
AN EARLY MORTAR



OPEN



CLOSED

FIG. 8 FIG. 9
PRUSSIAN BREECH LOADING
MECHANISM - 19TH CENTURY

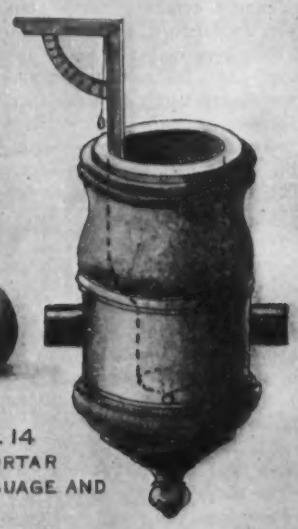


FIG. 14
16TH CENTURY MORTAR
WITH SIGHTING GUAGE AND
STONE BALLS

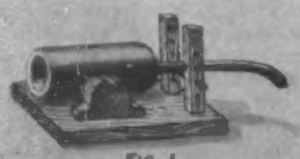


FIG. 1
CERBOTANA OF 14TH CENTURY

FIG. 7
A GERMAN BREECH LOADER
16TH CENTURY

FIG. 15
A TRABUCCHO OR MORTAR OF THE
16TH CENTURY

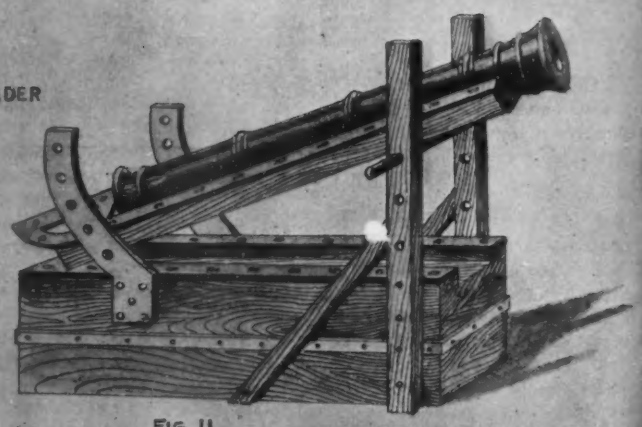


FIG. 11
OLD ITALIAN FIELD PIECE OF THE
15TH CENTURY

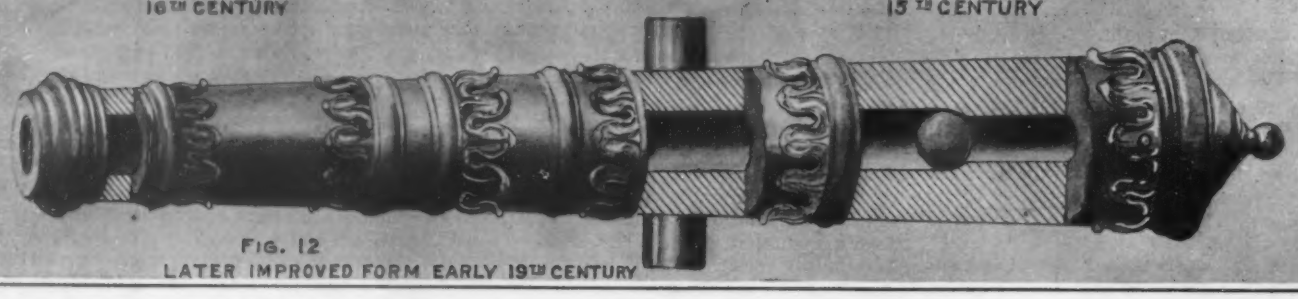


FIG. 12
LATER IMPROVED FORM EARLY 19TH CENTURY

Cannon of various periods and types, involving many of the principles of present-day artillery

Prototypes of Modern Artillery

Cannon of Several Centuries Ago Were Based on Same Principles as Present-Day Pieces

THE artillery that is being used in the battles of today is not a recent institution. As far back as the fourteenth century the Italians produced a cannon which in principle was not unlike the modern field gun. The huge Krupp and Skoda howitzers, before whose battering the most powerful fortresses have crumbled in the present war, cannot lay claim to being innovations, for artillery involving the principle of high trajectory fire has been employed in the battles of the past several hundred years.

As far back as the middle of the fourteenth century the Italians produced a cannon which was mounted on a wooden carriage, the cannon and carriage together being known as a *cerbotana*, which is illustrated in Fig. 1 of the accompanying illustrations. A few years later this piece was followed by the so-called *cerbotana ambulatoria*, illustrated in Fig. 2. This, in turn, was succeeded by the piece shown in Fig. 3, and again by the *orgue de bombardes*, appearing in Fig. 4. The *orgue de bombardes* was provided with a number of barrels, for the purpose of delivering volleys at a time instead of single shots.

Another type of cannon developed during the fourteenth century is shown in Fig. 5 and is attached to a wooden firing platform by means of metal bands. The platform, in turn, is mounted on two wheels to facilitate transportation and is provided with a wooden shield for the protection of the gun crew.

In the way of a novelty an elbowed *bombarde* was introduced during the fifteenth century. The fire chamber of this piece was placed at right angles to the ball chamber, but the piece was found to be so lacking in solidity that it was soon condemned as impracticable.

During the sixteenth century the breech method of loading made its debut, a German cannon said to be of that period and provided with a breech-loading mechanism being shown in Fig. 7. Its mechanism consisted of a breech lock which was simply pushed into the rear end of the bore and locked there with a pin or key passing through slots in the gun and in the breech block.

About the middle of the nineteenth century the Prussians invented a breech mechanism composed of two wedges. As will be noticed in Figs. 8 and 9, showing the breech-loader in open and closed positions, the wedges have equal angles and are placed side by side in a hole that is bored at right angles to the bore of the cannon. When the wedges are allowed to drop, the holes bored in each are aligned, access being thus gained to the rear end of the cannon bore for the loading operation. When the shot and powder have been placed in the cannon, the wedges are pushed upward and firmly secured in place by turning the winged screw which causes the wedges to spread and effectively seal the rear end of the bore.

The most primitive of cannons shown in the accompanying illustration appears in Fig. 10. It was a single tube or chamber of iron, open at both ends and bound with a sectional wooden casing that was held in place by metal straps. The bore of this early cannon appears to have been 20 centimeters, while its length was one meter. Stone balls were used as projectiles. Accompanying this cannon were all sorts of implements, such as tongs, pinchers, forks and large hammers, evidently intended for the loading operations.

In Fig. 11 is shown an Italian field piece which came into use during the fifteenth century, and which was intended solely for the throwing of stone balls upon houses or fortifications. This, obviously, is a prototype of the present siege artillery. As will be noticed in the illustration, the barrel of the gun was inclined at an angle in order to secure high trajectory fire the same as that employed in the siege guns of the present day. The angle of fire was regulated by altering the supports at the front and rear ends of the cannon. No wheels were provided for this piece inasmuch as it was intended to be used for some length of time in one location.

Cannons of more modern design and form are shown in Figs. 12 and 13. These pieces were described in terms of the ratio of the diameter of the bore at its mouth as a unit, with the length of the bore and the powder chamber of the gun. For example, the length of the bore of the gun shown in Fig. 12 is 18 mouths, the bore of the powder chamber is four mouths in length and five sixths of a mouth in diameter, while the customary charge of powder is two thirds the weight of the ball.

The mortars or *trabuccho* shown in Figs. 14 and 15 were used as early as the sixteenth century and, as will be noticed, the angle of fire was determined by a gage and plumb line. The ammunition was in the form of stone balls, some of which were as large as 25 inches in diameter.

"Land Cruisers" in the Battle of the Somme

"TANKS" they have been dubbed by the mass of British fighting men at the front; but among the more discerning minority they have more aptly been set down as "land cruisers."

And such in truth they are, as a brief study of this, the very first photograph of the new war machine to be published, will show. For, like the fighting ship of the seas, it is built solely of steel, and from deck to keel is plated with armor sufficient to protect its vitals against such projectiles as are likely to come its way.

Dissect the naval cruiser, and you will find that its vitals (engines, magazines, steering gear, etc.) are contained within a sort of inverted, armored box, consisting of sides, ends and roof. So in the land cruiser the engines, fuel tanks, steering gear, ammunition supply—to say nothing of the crew, are all snugly sheltered from the bullets of the enemy, from whatever direction they may come, even if from above.

Like the ship, the "tank" is steered by means of a rudder at the stern—represented by the pair of wheels in the forefront of the picture—for the view is taken from the rear, not the front of the machine. Possibly the steering is also done by the separate manipulation of the tractor belts.

And lastly, to make the parallel complete, the battery of Maxim guns is mounted in two sponsons amidship, one on each broadside. So strict is the parallel here, that we may describe the concentration of fire in true shipshape fashion by saying that the land cruiser has a bow and stern fire of four guns and a fire of three guns on each broadside.

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The first photograph to be published of the "tanks" or "land cruisers" on the Somme

The machine is driven by two broad caterpillar belts, which extend for its full length. An interesting feature is the upward inclination of the forward one third of the belts, at an angle, apparently, of between 30 and 40 degrees. It is this feature which enables the cruiser to "breast a heavy sea"—that is to say climb over a bank, or lift itself out of a shell hole. For when the rear two thirds of its length is resting on one side of the shell hole, or battered down trench, the upwardly-sloping forward third is bedded against the other side, and because of the heavy grip of its tractor belt, exerts a powerful lifting effect, which carries the front end of the machine up the slope.

The photograph shows a land cruiser in distress. The right-hand belt has parted, and the broken end, evidently, has caught in the machine. As it moved forward, and the belt was drawn over the double sprocket wheel (plainly discernible in the photograph) the belt was pushed up into a loop, clear of the rail.

The upward slope at the front end explains the feats of crushing down trees, walls, and even buildings; for the machine would begin to climb up on an obstacle, using its own great weight to bend over and crush down everything in its path.

The Electrical Exposition and Motor Show of 1916

THIS year's Electrical Exposition and Motor Show, held at the Grand Central Palace, New York, from October 11th to 21st, reflected as in years past the progress of electricity in the home, in the industries, in our National defense, and in practically every other line of human endeavor.

Illumination and illuminating devices appeared to be the prime feature of the recent exposition, especially to one who has visited the electrical expositions of the past half-dozen years and has witnessed the constant improvement in the lighting arrangements, beginning with the pioneer tungstens and terminating for the time being in the employment of blue-glass, nitrogen-filled tungsten lamps. The general illumination of the exposition was most striking, for in stepping into the building from the daylight outside the visitor was surprised to find the same kind of light he had just left; in truth, one could hardly refrain from casting a look upward at the ceiling to ascertain the source of the "daylight," only to find thousands of pale blue bulbs where a skylight was expected.

Because of their wide employment in photographic work, particularly for motion pictures, a comprehensive exhibit of Cooper-Hewitt tubes was of much interest to the multitudes. Here were to be seen tubes in various sizes, ranging from 10 to 67 inches for photographic as well as for industrial purposes. Among the newer forms of this mercury-vapor lamp was a table lamp possessing several unusual features. Meanwhile, in the metallic filament lamp exhibits there were to be found lamps ranging from the small one- or two-candle power flashlamp bulbs up to the 1,000-watt bulbs for general illumination. Photographic-blue lamps, which are coming more and more into use in photographic studios where artificial lighting is employed, were shown in various sizes, along with 40- and 60-watt argon gas-filled lamps which, because of their blue-glass bulbs, emit a light that is fairly free from red and yellow rays, and hence closely simulates daylight. In marked contrast was the intense orange light shed by a neon tube, which had the psychological effect of making one cheerful because of its warm and pleasant lighting of all objects. The color-testing value of a new form of tubular lamp was disclosed in a darkened booth, where a bunch of violets was successively shown under the rays of that lamp and under the rays of an ordinary incandescent bulb. The same experiment was repeated with a piece of meat, with rather startling results.

A large part of the exposition was devoted to the application of electricity in the home, and accordingly there were to be seen the usual gamut of electrical appliances, starting with the electric toaster and ending with the electric washing machine. To the casual observer these exhibits did not present any startling innovations, although more likely than not there were numerous improvements and refinements presented in this year's offerings over those of previous years. One point, however, was much in evidence: electrical cooking devices, particularly table stoves, are being made so as to combine what were heretofore several separate appliances, such as toasters, broilers, frying pans, egg poachers, and other forms of cookers. It is not only in the matter of variety of operations that the user of such a table stove gains, but in the matter of current consumption; for it is now possible, with the same expenditure of current, to carry on two or three cooking operations and thus prepare an entire breakfast or light luncheon on the dining-room table at the cost of a few cents for electricity. Although electric cooking has long been admitted a costly proposition where current is generated by steam power, much is being done to reduce the cost and to bring electric cooking within the reach of everyone by the later-day appliances.

According to the exposition, electricity is carrying on its invasion of the industrial field without signs of a halt. There was to be seen an extensive line of motor-driven machines for practically every large industry, from the large, heavy-duty lathe for the manufacture of shells, to the small, high-speed circular steel blade for the cutting of several dozen pieces of cloth at a time in clothing manufacture. The wide-spread employment of electricity in the modern dairy was learned by a visit to the feature exhibit of a leading milk distributor, where the electric milking of the cows and the subsequent treatment of the milk attracted much attention. Another feature was an electric bakery that

(Continued on page 395)

The Traveler's Tree—a Popular Misconception

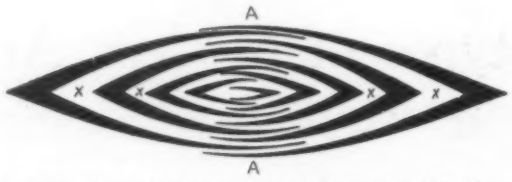
ONE of the most curious plants now pretty generally introduced in the parks and many lawns of private residences in tropical America is the so-called traveler's palm which is familiar to botanists under the name *Ravenala madagascarensis*. The traveler's palm is not a palm at all, but is closely related to the banana plant, a member of the musa family. While the trunk in general appearance is like that of a palm, the leaves are arranged at the top in two rows on long stalks diverging in the form of a gigantic fan. The leaf bases are borne on opposite sides of a genuine trunk one above the other. These sheathing bases fit so closely together as to preclude the evaporation of the water that runs down the channel on the upper or inner side of the midrib. By puncturing the midrib of any of the leaves may be obtained a considerable quantity of water, which is said to be used by the weary travelers to allay their thirst. It is for this reason that the tree received the name traveler's palm or traveler's tree.

Our diagram represents roughly a cross section through the cluster of leaf bases which are folded together lengthwise like the leaves of the iris or flower-de-luce. These leaf bases correspond to petioles or leaf stalks of ordinary leaves as in the oak or cherry, and in the case of the traveler's tree what would be the upper surface of the leaf base is within. Thus, each leaf base straddles the next inner one which is known as "equitant." It is in the spaces marked x that the water collects. At the points A A the leaves clasp very close so that the water in the spaces x cannot escape.

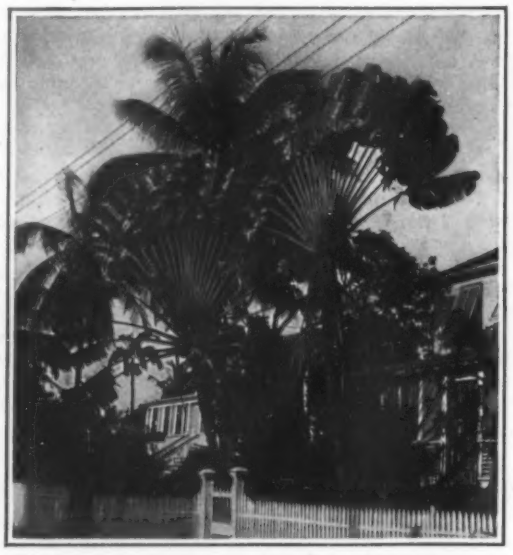
Stories have been going the rounds in newspapers advocating the planting of this tree in the dry arid regions of tropical countries for the purpose of supplying water to travelers. In reality there is little else but sentiment in such stories and many readers are misled as to the true character of this tree, which grows naturally only in Madagascar and thrives only in the vicinity of water. While most stories state that the tree has been created to supply the tired wayfarer with the much needed water to quench his thirst in passing from one spring to another across the arid waste, the leaves in fact are never punctured except from curiosity or wantonness. Moreover, if the traveler were to perforate the leaf bases for the sake of the water they contain, he would find a vegetable-flavored liquid filled with dirt and larval insect in the reservoirs of the traveler's tree instead of clear, fresh water fit to drink.

One writer who lived in Madagascar for many years states that if the uses of the tree are to be taken as a basis for its name, the tree might more appropriately be named the household tree, because in its native habitat its leaves furnish the people with thatch and sides of their houses; the leaves are used also extensively for making a great variety of minor household articles, and the trunks, which are woody and durable in contact with the soil, are used for posts and even for flooring in warehouses where it becomes extremely hard and lasts indefinitely. The seeds are said to constitute a wholesome food.

The tree is now cultivated in Central and South America for ornamental purposes. A feature of general interest is presented by this tree in its peculiar arrangement of its leaves which are oblong in form, and are larger in size than those of any other known plant. The flowers are small and numerous and arranged on a spike that is produced from the center of the stem as in the banana.



Section through a cluster of leaf bases showing how they trap water



The Traveler's tree popularly supposed to store pure water for thirsty travellers

How Fast Does a Fungus Grow?

AN observant student of nature will have remarked that among the specimens of vegetable life which grow with notable rapidity are the fungi. Frequently in the morning one will see a mass of fungi pushing their way up through the ground at a place where there was no sign of life the night before. This quick development is mainly due to the fact that the mycelia, the vegetative system which the untechnical observer would be apt to designate as "roots," and from which the spore-bearing processes arise, are often present in the soil for months in a dormant state. With the incidence of the right conditions for growth things happen with amazing suddenness.

The photographs shown herewith record the growth of a specimen of the Fly Agaric, *Amanita muscaria*, a species fairly well diffused through the temperate regions of the earth. At two o'clock on a humid afternoon the top of the cap is seen just pushing its way through the soil. Four hours later we note a decided increase in the size of the organism. Next morning at six o'clock the change is even more marked, while in another twelve hours—making twenty-eight hours in all since the first appearance—the development of the toadstool is complete. The height was then nearly five inches.

In many tropical species even this rapid rate of growth is far outstripped. A specimen of stinkhorn fungus, Phallus aurantiacus, was observed by a competent naturalist in Hawaii to extend at a rate of more than an inch a minute during its final stages of development. Indeed, it was declared to be possible to *see* the growth of this strange plant.

Injecting Iron into Sick Pineapples

A DISCOVERY which may greatly increase the output of pineapples in the Hawaiian Islands has been announced by M. O. Johnson, chemist of the United States experiment station in Honolulu. He has developed a method of neutralizing the action of manganese on pineapples grown on soils heavily impregnated with this mineral.

An area variously estimated at 6,000 to 10,000 acres on this island has black-top soils which are impregnated with manganese in proportions up to 2 and 3 per cent of the weight per acre-foot. When pineapples are planted on these soils they grow well for a time, but as the harvest time approaches the leaves drop and become yellow. The fruit usually forms, but does not develop properly, and it ripens before attaining full maturity, or, on the worst lands, fruit hardly forms at all.

The manganese pineapple is not good to eat out-of-hand and is hardly worth canning, for no sugar is formed and the juices have a peculiar acidity. In years past much good money that has been put into pineapple plantations has vanished because of the poor crops of unsalable fruit produced on fields containing abnormal quantities of manganese.

The subject has been investigated by the Hawaii experiment station. Bulletins 26 and 28 and press bulletin 23 deal with it. From a practical standpoint, all that had been accomplished until recently was to advise prospective planters to have chemical analyses made of their soils, and if they found manganese present, not to plant pineapples.

Fertilizer experiments have been undertaken, but no results were obtained except from barnyard manure. When manure was added to the fields at the rate of 12 or more tons per acre, the pineapple grower sometimes had a fairly normal crop of the ripened product and sometimes did not. Stable manure at the rate of 12 tons per acre was an expensive proposition, and had it not been for the Army post at Leilehua, even enough manure for experimental purposes would not have been obtainable.

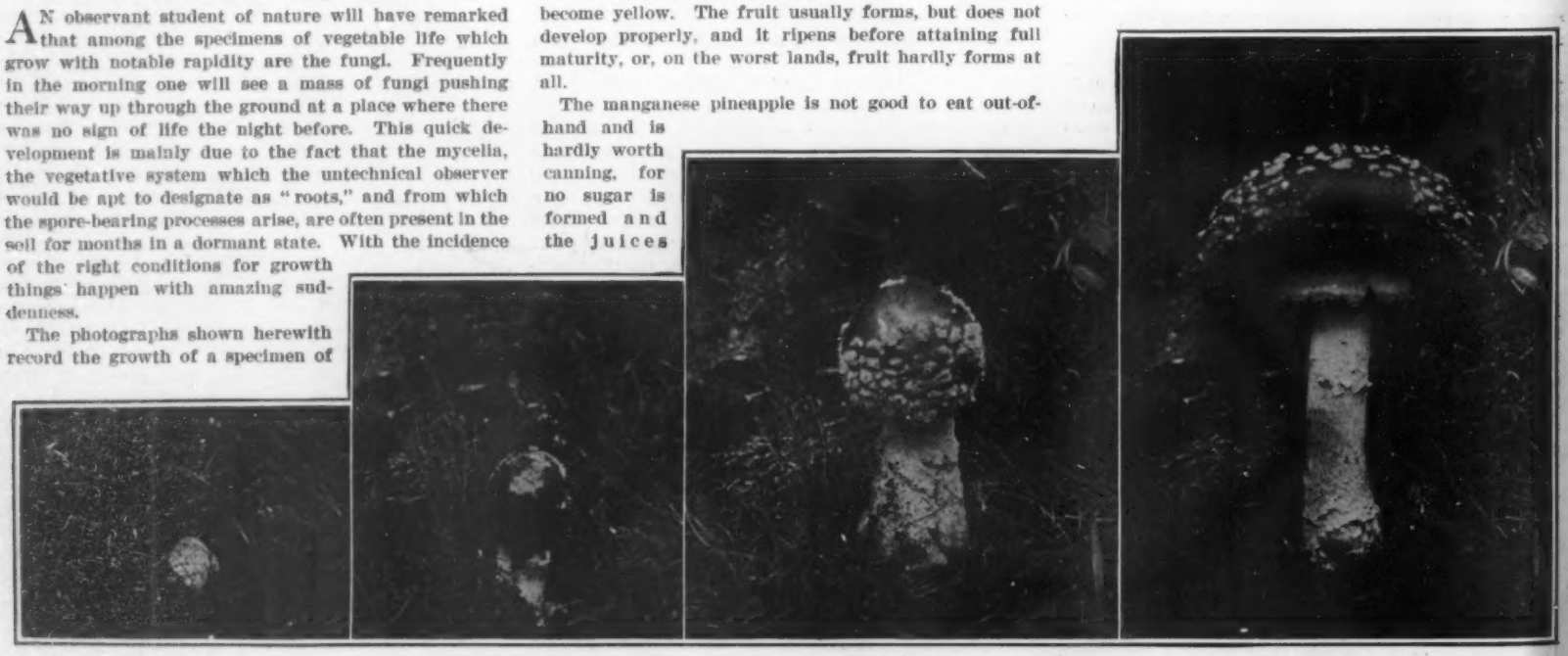
In the investigations conducted during the past year, charts were prepared, and soil and pineapple-plant analyses plotted, with the result that it was observed that the manganese dioxide present in the soils was alkaline in its reaction and that when it occurred in unusual proportions it rendered all the iron in the soil insoluble. It therefore appeared that the sick pineapples were dying from lack of iron, although chemical analyses showed as high as 20 to 30 per cent of iron present in the soils. The case was parallel to that of the ancient mariner, who saw "water, water everywhere, but not a drop to drink."

There was an abundance of iron in the Kunia and Wahiawa soils, but it was locked up with the manganese so firmly that the pineapple roots could not get hold of any of it. The experiments proved that it was lack of soluble iron that was causing the trouble. By means of the simple expedient of injecting a hypodermic needleful of iron sulphate solution into a yellow and discouraged-looking pineapple plant, a change was produced, for it promptly turned green, took on a new lease of life, and grew as all proper pineapples should grow.

It would be out of the question to inject into each individual pineapple plant, and field experiments were undertaken to find some other way. No results were obtained by putting iron salts into the soil, where they could be taken up by the roots in the usual way, so the plan of painting or wetting the leaves with a copperas solution was tried and proved successful. Sick pines, with yellow, droopy leaves, were able to absorb enough iron through their leaves to satisfy their needs.

The ripening of the pines has been watched with considerable interest, as some doubts were felt as to the flavor of the pineapples themselves. The palatability tests, just performed, have indicated no appreciable difference between the flavor of treated pines grown on manganese soil and the normal pines grown on the best pineapple land. The intense acidity of the untreated pines on manganese soil is well known to those familiar with local pineapple problems.

The details of the application of this method have not been fully perfected, as the most suitable strength of solution ,the number of sprayings, and other matters are being worked out. Some of them are best determined by the pineapple growers themselves, especially where the individual facilities for work may vary considerably.



First day—2 p. m. First day—6 p. m. Second day—6 a. m. Second day—6 p. m.

Photographs of a growing toadstool, showing speed of development

Inventions New and Interesting

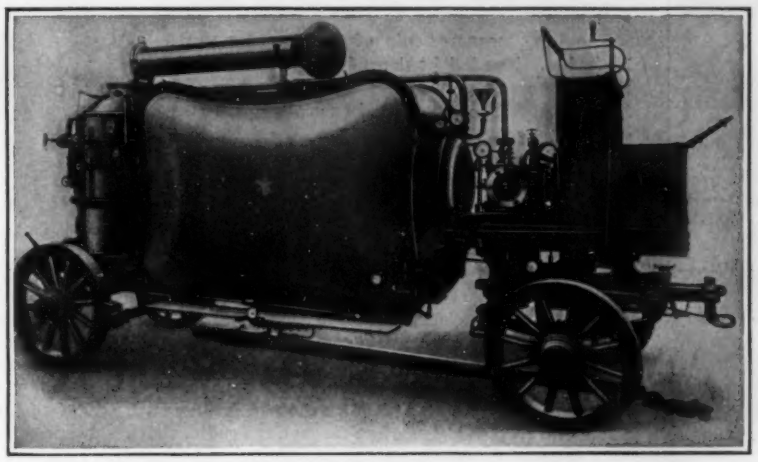
A Department Devoted to Pioneer Work in the Arts

A Traveling Disinfector

WE illustrate herewith the apparatus for a German municipal undertaking which it seems might well be imitated on this side of the water. It is nothing less than a perambulating disinfecting plant in operation in the city of Charlottenburg.

The disinfection accomplished by this device is not to be confused with house fumigation; in fact, the machine is designed to be used only on such small articles as can be placed inside the large receptacle. In this they are exposed to steam at a pressure of one tenth to two tenths atmosphere, and at a temperature of 105 deg. Cent. It will be understood that at this temperature there is no soaking of the articles treated, but that all germ life must be destroyed.

Such an apparatus would indeed be a valuable adjunct of the health inspection service of our large cities.



A disinfecting plant on wheels

A Camera that Photographs Birds on the Wing

THE device appearing in the accompanying illustration is not an anti-aircraft gun, as might be supposed at first glance. It is merely a "gun camera," constructed by Stanley Clisby Arthur, State ornithologist of Louisiana, and used by him as a "field piece" when photographically hunting birds and wild animals.

To secure photographs of bird life so that the plumage detail, identification marks, and such matters dear to the heart of the trained bird student or to those who merely delight in viewing pictures of nature, a large image of the object photographed must be secured. The difficulty of getting close enough to the members of the vast winged tribe to secure such size or detail is known to all photographers who have engaged in this class of work.

There are telephoto lenses that give the large figures desired, but the two to five seconds' exposure needed by this type of objectives is practically impossible when photographing anything so lively as a bird. And it was while experimenting to secure large images with a minimum exposure that Mr. Arthur came upon the idea for the gun camera, which consists of an ordinary reflecting type of camera with the usual bellows extension, mounted on a carriage with wheels for the sake of portability and to allow quick action in focusing. The carriage also permits the elimination of the awkward tripod when slow exposures are required. The bellows is supplemented with a tube of considerable length to admit of the use of lenses from 30 inches e. f. and over, instead of the ordinary 6- or 8-inch lenses.

The great focal length used in connection with the gun camera increases the size of the image secured on the negative without the loss of speed as when a telephoto or a single part of a combinable lens is used. With a 7½-inch lens, if a bird photographed will give an image a quarter of an inch in height, with a 30-inch lens from the same position a 2-inch image will be secured.

In the camera illustrated the lens is recessed in the far end of the tube so as to obtain the benefit of a lens hood when working against the sun or light. Focusing is accomplished in the usual manner by means of a milled head. The long lens tube is carried by a board sliding in grooves, so that it moves forward or backward as the camera is being focused.

Lenses of long focal length are expensive, at least if the modern anastigmats are considered. But for his gun camera Mr. Arthur makes use of lenses that have been drugs on the market for some time. Lenses of this type are known to the trade as "Long Toms," the diaphragm openings being secured with "Waterhouse" stops. These lenses have been relegated to the obsolete shelf since the advent of the newer lenses with their iris diaphragms, and can be purchased at prices ranging from $5 to $15 from almost any large photographic dealer. While these lenses are in the rapid rectilinear class, still for landscape and animal work they are unexcelled even by the modern anastigmat, because of the roundness and brilliancy of the image secured. These old-time lenses were made to cover a 11- by 14- or a 16- by 20-inch plate and over, and work at a speed of about f.8. Owing to the fact that it is only the "heart" of the light passing through these lenses that is employed in conjunction with a 4- by 5-inch negative plate in the gun camera, exposures up to 1/700 and even 1/1000 can be made and fully exposed negatives secured if the fast plates are used.

The gun camera which permits the taking of bird and animal pictures at a distance, without the employment of expensive lenses

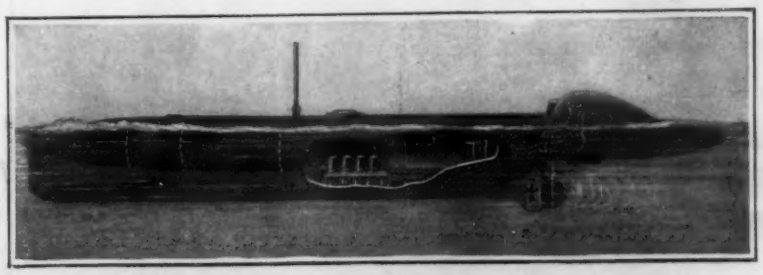
The gun camera is so constructed that it is readily taken apart to facilitate transportation. When set up it is perfectly rigid, and with it it is possible to photograph birds on tree tops, or stop them in flight. An improved model of the camera is being built by Mr. Arthur, which calls for the use of pneumatic-tired bicycle wheels and some minor changes in the appearance of the gun camera; but in the main essentials the camera remains the same—so simple that anyone interested in nature photography can readily construct one.

A Man-Controlled Torpedo

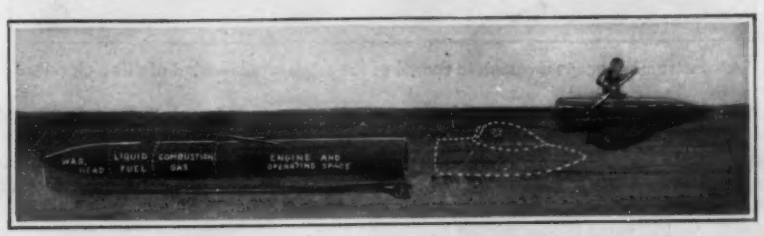
SO vastly greater are the difficulties of torpedo attack in actual battle than during undisturbed torpedo practice in peace-time, that the results obtained with this weapon during the big engagements of the war have been very disappointing. Although in the great battle of Jutland the numerous German destroyer flotillas made frequent attacks on the British fleet, only one hit was recorded during the many hours of the fight. Such astonishing accuracy, even at long ranges, has been obtained in peace-time torpedo practice, that high hopes of its efficiency, when battleship fleets lined up against each other, had been entertained by naval officers. As a matter of fact, the few successful hits have been obtained at short-range; practically at point-blank range.

Consequently, inventors have turned their attention to the question of building a man-operated torpedo in which an intrepid navigator would guide the deadly weapon right up to the mark, at the risk of his sharing the fate of the torpedoed ship. In the case of some of these designs, the navigator was supposed to leap overboard when he had come near enough to make a hit a certainty, trusting to his cork-jacket to keep him afloat until he might be picked up.

In the case of the man-operated torpedo herewith illustrated, the inventor attaches to the torpedo a false stern, which is capable of separate flotation and is provided with oars by which the daring navigator is expected to make his way back to a friendly ship or the nearest shore. The torpedo proper is driven by compressed air while upon the surface or awash, the exhaust taking place through a vertical pipe. If it is desired to make a complete submersion, the pipe is lowered and gas is fed to the engine from a compressed-gas tank. Submergence planes attached at the sides of the torpedo serve to carry it to any desired depth. When the navigator has driven his torpedo to within point-blank range and has set the controls for the desired depth and course, he operates a rod which introduces compressed air between the torpedo and the false stern which, as our drawings show, serves at once as pilot-house and life-saver. Separation between the two takes place, the heavy conning tower causes the detached portion to turn over, and the pilot finds himself adrift in a boat which cannot be capsized.



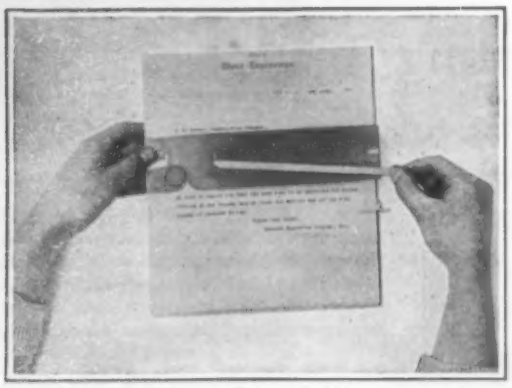
Pilot controlled torpedo approaching within range at the surface



Torpedo submerged, pilot afloat in detachable section

Pipe-Line Transportation

RESOLUTIONS have been introduced in Congress from time to time directing the Federal Trade Commission to institute an inquiry into various phases of the petroleum industry, the first of these resolutions dealing with the transportation of crude oil by pipe-line systems while the most recent had to do with conditions responsible for the somewhat abnormal increases in the price of gasoline. The first of the reports, "Pipe-Line Transportation of Petroleum," is now completed and may be procured from the Superintendent of Documents, Government Printing Office, Washington. Although at the outset the investigation was intended to cover pipe-line transportation throughout the United States, a subsequent resolution directed an inquiry by the Interstate Commerce Commission which involved in part the subject of pipe-line transportation and, in order to avoid duplication, that part of the investigation concerned with pipe-line systems operating east of the Mississippi River was taken over by the Commerce Commission. It will be recalled that in 1914 the Supreme Court held that all pipe lines engaged in transporting oil in interstate commerce were common carriers and, therefore, within the jurisdiction of the Interstate Commerce Commission. The present gasoline situation deserves much attention.



The binder in place and the tape just about to be swung into tape tip of the primary locking slot

Packeting Papers Efficiently With a Cardboard and Tape Belt

"RED TAPE" has become a synonym for entangling routine and waste of time; yet the good old red tape once so common in the packeting of documents, had enduring virtues. Papers tied with it were held secure for any time, no matter what the size and shape of the parcel. Uncanny knots that either failed to remain tight or persisted in doing so just when they should not, doomed this sturdy fabric. But tape, combined with cardboard, has come into its own again. With these two materials a binder has lately been invented that is likely to prove a boon in keeping papers firmly bound yet readily accessible.

The average person may not appreciate how important a part the packeting of papers plays in a busy office, especially in organizations given over almost entirely to correspondence and the handling of letters, documents and securities, and what a problem its proper performance presents. Clips slip or fail to grip when heavily taxed; rubber bands are affected by heat and are comparatively short lived.

An ingenious official, who has had to battle with the packeting and filing problem in one of New York's biggest institutions, has invented what he calls a *Tibler* —such being the combined initials of its virtues. The illustrations show plainly the get-up of the binder with its strip of cardboard and its cleverly arranged locking device which grips and holds the tape. Experience has proved this binder is in truth tight, instantly binding, lasting, and easily removed, as claimed by its name.

Pneumatic Road-Scarifier on a Road Roller

UTILIZING the weight and power of the ordinary road roller and eliminating the rather unsatisfactory porcupine road scarifier, the latest type shown in the accompanying illustration is worked by compressed air. It consists of a pneumatic cylinder carrying on the lower end of its piston a yoke with the cutting pins. The yoke is forced down by admitting compressed air into the top of the cylinder, shoving the scarifier teeth into the ground and keeping them there during the work. By admitting air to the under side of the piston, the teeth are withdrawn from the road. The air used is made in a small compressor driven by the roller engine and stored in two tanks beside the piston as shown.

Operated by compressed air, this road roller and scarifier performs its work most efficiently

How Did It Happen?

A Novel Hoist Recorder for Mines and Elevators, Designed to Answer this Question

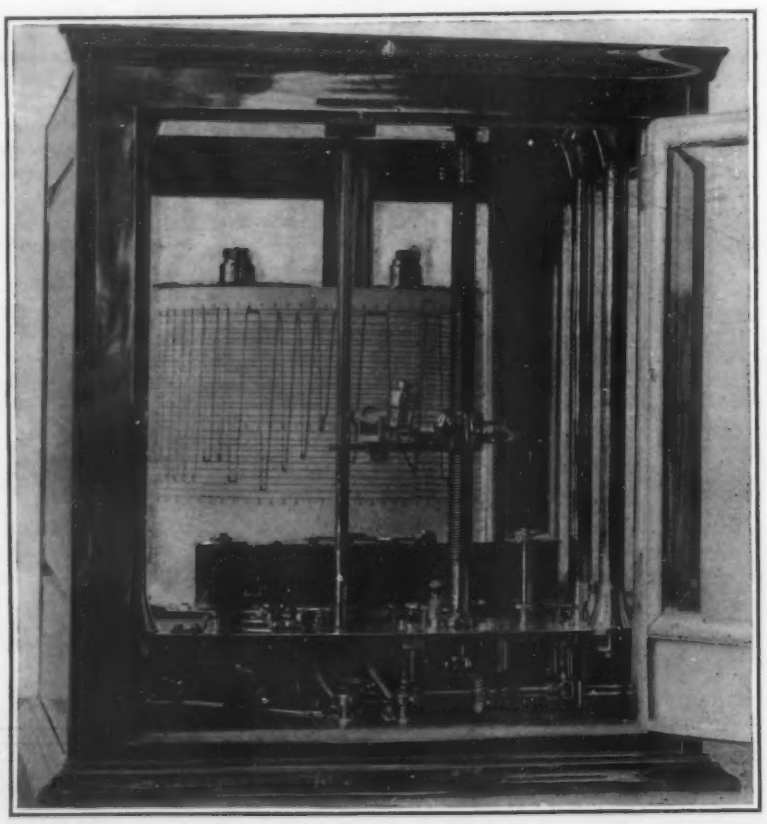
By Frank C. Perkins

THE accompanying illustration shows a hoist recorder for mines and elevators developed at Ishpeming, Mich., with a diagram or record taken on this instrument. This recorder will furnish a complete record of the movement of the skip for each shift of 12 hours or less, showing the time taken in moving it from one point to another, showing all delays, the length and location of these, the number of loads hoisted from each level and the total amount hoisted daily. This record will also furnish valuable evidence in the case of accidents connected with the skip, and delays and mistakes which occur from time to time, for it will eliminate conflicting reports between men underground and engineer in charge of the hoist.

It is pointed out that where electric signalling is in use this machine will record the signal given, so that where different signals are used for the different materials, it can be seen just what material is being handled, and from and to what point. Also the exact time signals are given may be recorded, so that it can be plainly seen whether delays are caused underground or on the surface. Where "Pull Ball" signalling is used a contact can be arranged which will give the same results.

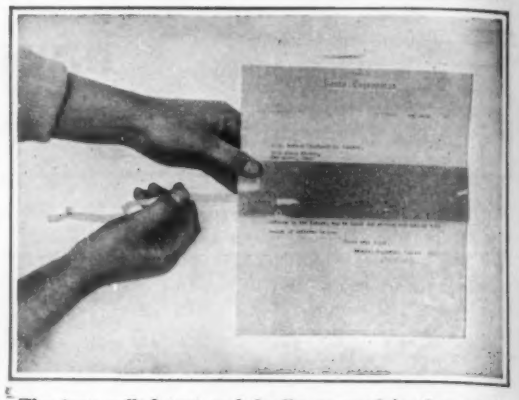
The base measurements of the recorder are 16 by 16 inches. The height depends on the depth of mine, the recorders being made in three sizes; 15, 18 and 24 inches high. The recorder can usually be attached, as convenience dictates, to the end of the drum shaft, on the reverse shaft, on the indicator shaft, or on any shaft which runs true and moves and reverses with the hoisting drum. The recorder should not be placed so far from the shaft to which it is connected as to cause loose motion in the chain.

The means of recording the movement of the skip are simple. There are two drums on vertical spindles. One drum, driven by a clock, winds the sheet from the other drum so that the plan and exact length of time idle are registered by a pen attached to a nut working on the screw noted in the foreground of the photograph. When the skip moves up or down the pen records such movement, receiving its motion through the chain, shaft, bevel gears and screw. In the accompanying illustration the glass door in front of the instrument is thrown open so as to expose the entire mechanism.



This instrument keeps a complete record of the work in mines and of mine elevators

As it is essential to have a thorough knowledge of the working conditions, these recorders are of inestimable value to any mining company. The device records every movement of the skip and affords a record of the kind of signals and the exact time they were given, so that it can be seen just where delays occur and whether caused underground or by the engineer in charge of the hoist. The charts being made so that the position of the levels and important points conform with the same in the mine, these records can be read very easily. The record of the signals given is also very plain, showing just where the skip was when a signal was given, and the nature of that signal.



The tape pulled taut and finally secured in the notch that double locks the packet

Manufacture of Bar-le-Duc Jelly

BAR-LE-DUC jellies and jams take their name from the town of Bar-le-Duc, capital of the Department of Meuse, France, which specializes in their manufacture. They are prepared with currants specially chosen on account of their size, but which are not produced by any particular variety of currant bush. The following outline of the method of preparation may be of interest:

During the month of July each year, trained workers receive from the factories quantities of currants which they take home for the purpose of removing the seeds. In this process the berry is held in the fingers of one hand and the seeds are removed by means of a goose quill sharpened to a fine point. The work is exceedingly difficult and requires considerable dexterity acquired by long practice.

As soon as the currants are returned to the factory, sugar is added and the fruit cooked. The quantity of sugar used is much greater than in ordinary jams and jellies, owing to the fact that the jelly boils for only a short time in order to avoid the oversoftening of the berries. Softening, it may be added, would cause them to lose their attractive appearance, which is the specialty of the Bar-le-Duc product, the whole berry being seen through the glass jar. When prepared, the jelly is placed in small pots closed with a metal cap, and the pots are placed in boiling water to further insure the keeping qualities of the product. As Bar-le-Duc jelly is prepared chiefly for the export trade, this latter is essential.

Five firms at Bar-le-Duc manufacture jelly in normal times. It is doubtful whether the jelly is now being made, owing to the fact that the district is in close proximity to the firing line and that many, if not most of the civilians have left the region.

French statistics do not show the quantity of this jelly exported, but upon examination of the total exports of jams prepared either with sugar or honey, it is found that the French export trade has decreased but little since the war, 1,005 tons of such jams having been exported in 1915, as compared with 1,025 tons in 1914 and 1,132 in 1913.

The only factor which appears to militate against the manufacture of similar jelly in the United States is that cheap female labor required to remove the seeds from the currants would probably not be available, thus raising the cost of production to a figure much above that in France. It is hardly possible that such labor could be replaced by machinery in the delicate operation of handling currant berries for the removal of the seeds. As far as the French production is concerned, it does not appear likely that normal quantities will be available until after the cessation of hostilities, as the cost of sugar, the principal ingredient, is now double that in time of peace.

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Our Latest Dreadnought, The "New Mexico"

(*Concluded from page* 383)

gun. This arrangement greatly assists the spotter in locating the fall of the shots, and making the corrections necessary in the elevation. Moreover, the placing of three guns in one turret effects a valuable saving of weight.

An admirable feature of the "New Mexico" is the exceptional height at which the amidships battery of 5-inch torpedo-defense guns is carried. There are 22 of these guns, four mounted in casemates on the main deck forward, four in casemates on the gun deck aft, ten in a central battery on the forecastle or spar deck, and four at the corners of the boat deck above the central battery. This arrangement gives a concentration of eight 5-inch guns forward and aft, and of eleven on each broadside.

A notable feature in this ship is the unusual extent and the great weight and thickness of the armor protection, which is more complete than that of any ship under construction for other navies, at least so far as is known. The great displacement of these ships—32,000 tons—has made it possible to clothe them with armor far in excess of that carried by the ships designed eight or ten years ago. Thus, the waterline belt, with a maximum thickness of about 14 inches, is 17½ feet wide, and this armor extends 8 feet below the waterline. The ship carries 16 inches of armor on the conning tower, and the port plates of the three-gun turrets are no less than 18 inches in thickness. Moreover, the whole side of the ship between the extreme turrets up to the main deck will be heavily armored, and with the side armor will be associated heavy transverse armor bulkheads and several horizontal armor decks.

The "New Mexico" is 600 feet long on the water line, 624 feet in length on deck; her breadth is 97 feet, her draft 30 feet, and her displacement 32,000 tons. She will be provided with four submerged 21-inch torpedo tubes, and her complement will consist of 1,056 officers and men. Her contract speed is 21 knots.

The Electrical Exposition and Motor Show of 1916

(*Continued from page* 391)

disclosed every process of bread and cake making under ideal sanitary conditions, operated by the students of the Murray Hill Vocational School of New York city. While somewhat remote from the general idea of the electrical exposition, the manufacture of silk perhaps commanded as much interest as any other exhibit. The product of the silk worms was put through the various stages of "throwing," "unskeining," "spooling," and "weaving." The looms exhibited had a capacity of from 10 to 40 yards of silk a day, and could accomplish everything in the line of intricate weaving except that done by the old-fashioned hand looms of France.

The Motor Show portion of the exhibition was represented by several exhibits of electric pleasure and commercial vehicles, and storage batteries. The clever maneuvering of an industrial truck or "electric stevedore" in and out of the aisles and dense crowds attracted the attention of many visitors, since the colored gentleman guiding the truck was undoubtedly piloting his vehicle under the most adverse conditions—conditions that would never be met with in actual work—with consummate skill.

The Federal Government, following its custom of recent years, was well represented by several of its departments. The Census Bureau presented an exhibition of the machines it employs in keeping track of how many people inhabit this land of ours. Tabulating machines, sorting machines, and counting machines were shown in operation, to the amazement of the onlookers. The Department of Foreign and Domestic Commerce, on the other hand, displayed a large variety of manufactured articles that are figuring in our recently acquired South American trade. Since

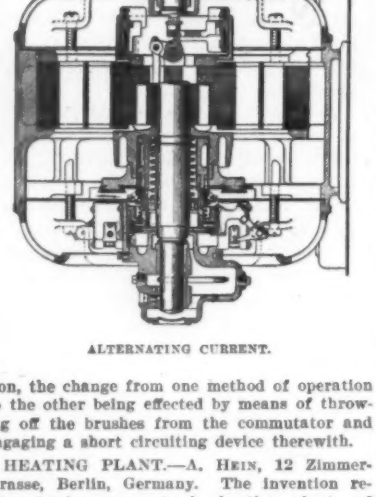
(*Concluded on page* 398)

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Electrical Devices

ALTERNATING CURRENT MOTOR.—H. W. JEANNIN, Warren, Ohio. This invention relates to electric motors so constructed as to start by repulsion and run normally by induction, the change from one method of operation to the other being effected by means of throwing off the brushes from the commutator and engaging a short circuiting device therewith.

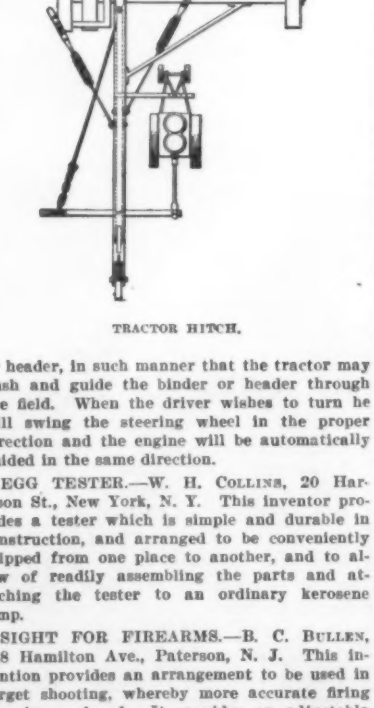


ALTERNATING CURRENT.

HEATING PLANT.—A. HEIN, 12 Zimmerstrasse, Berlin, Germany. The invention relates to improvements in heating plants of the kind in which a number of rooms are heated from a central boiler station. According to the invention which relates to a new process and to apparatus for carrying out the same, the rooms of a building are to be so heated that in all rooms the normal temperature is obtained at the same time.

Of Interest to Farmers

TRACTOR HITCH.—E. A. KIRCH, Rush Center, Kan. In this case the invention is an improvement in tractor hitches, and has for its object the provision of a mechanism for permitting a tractor to be attached to a binder or header, in such manner that the tractor may push and guide the binder or header through the field. When the driver wishes to turn he will swing the steering wheel in the proper direction and the engine will be automatically guided in the same direction.



TRACTOR HITCH.

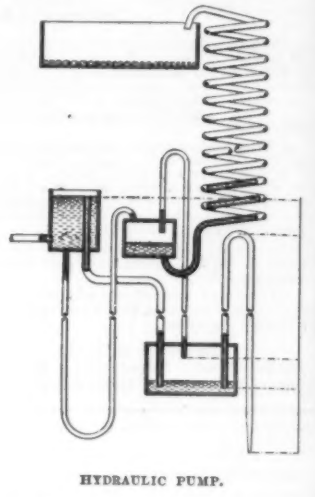
EGG TESTER.—W. H. COLLINS, 20 Harrison St., New York, N. Y. This inventor provides a tester which is simple and durable in construction, and arranged to be conveniently shipped from one place to another, and to allow of readily assembling the parts and attaching the tester to an ordinary kerosene lamp.

SIGHT FOR FIREARMS.—B. C. BULLEN, 148 Hamilton Ave., Paterson, N. J. This invention provides an arrangement to be used in target shooting, whereby more accurate firing may be produced. It provides an adjustable circular front sight so as to encircle the bull's-eye when the device is in use. It also provides a sighting device at the front and rear of the firearm, which may be adjusted to produce any sized opening so as to shut out all undesirable rays of light, while allowing the eye to view the bull's-eye and a small space around the same.

SIGHT FOR FIREARMS.

Of General Interest

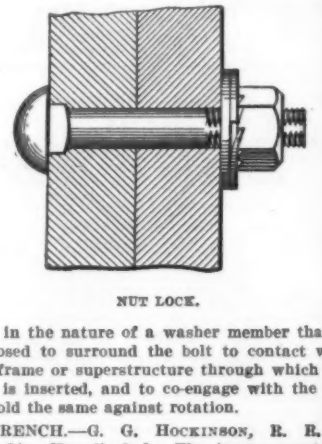
HYDRAULIC PUMP.—J. RITTER, The Fairlawn, 2400 Fruitvale Ave., Oakland, Cal. The invention relates to an automatic hydrostatic pump without reciprocating parts. Water flows into a compressor-tank and a charge receiving tank, the latter being forced through a spiral-shaped conduit to the service height by the hydrostatic pressure in the former, its functions depending solely on the water-supply. The spiral-shaped conduit can be substituted by a service of tanks, each tank having an exhaust-valve, which, however, never comes in contact with the liquid; so that if the charge receiving tank is connected sufficiently, liquids of any kind (kerosenes) can thus be raised to any height.



HYDRAULIC PUMP.

Hardware and Tools

NUT LOCK.—G. J. BENNETT, Richlands, W. Va. This invention relates to improvements in means for locking a nut upon a bolt, and an object of the invention is to construct a nut lock in the nature of a washer member that is disposed to surround the bolt to contact with the frame or superstructure through which the bolt is inserted, and to co-engage with the nut to hold the same against rotation.



NUT LOCK.

WRENCH.—G. G. HOCKINSON, R. R. 8, Box 31a, Howell, Ind. The improvement refers more particularly to wrenches in which a pivoted head is used carrying jaw members relatively adjustable to each other, and has for its object to produce a wrench which is adjustable for use in various positions and upon objects of various sizes.

Machines and Mechanical Devices

CONDIMENT HOLDER.—J. E. YOUNG and E. V. YOUNG, 5022 19th Ave., Brooklyn, New York, N. Y. This invention relates to a double-chamber condiment holder, from either of which chambers an ingredient can be dispensed without discharging from the other chamber. It provides an inexpensive holder having two independent concentric chambers refillable from opposite ends.

ADJUSTABLE SUPPORT FOR CAMERAS.—C. M. SUCK, Salem, W. Va. An object here is to provide a device secured to a tripod and including a seat adapted to be detachably secured to a camera, said seat being pivotally mounted so that the same may be adjusted to vertical and horizontal positions, means being also provided for retaining said seat in its adjusted positions.

PNEUMATIC HYDRAULIC GUN.—R. C. HILL, Box 1017, Memphis, Tenn. An object of this invention is the provision of a gun which may be fired by pneumatic means working in connection with a source of liquid supply. A further object is the provision of a pneumatic-hydraulic gun which may be unbreeched without loss of liquid.

PEARL BUTTON CHUCK.—P. F. DUSHA and A. FEYK, Address Holub Dusha Co., 1797 1st Ave., New York, N. Y. It is the general object of this invention to provide a chuck which holds the button in such a manner that the shank can be diametrically drilled without danger of cleavage of the button shank, the chuck being so designed as to tightly grip the front and back of the button with considerable pressure.

STOCK HOLDING DEVICE FOR BUTTON CUTTING MACHINES.—P. F. DUSHA and A. FEYK, address Holub Dusha Co., 1797 1st Ave., New York, N. Y. The invention pro-

vides a device which is of comparatively simple and inexpensive construction, durable and efficient in use, and so designed as to enable blanks to be cut from the stock with the greatest economy and without liability of the stock turning and injuring the operator.

ADDING MACHINE.—J. W. WITSELL, 172 Ashley Ave., Charleston, S. C. This invention provides in a device, spring mechanism arranged adjacent to each number wheel for operating the succeeding wheel, the said mechanism being placed under tension by the movement of the preceding wheel, and released at predetermined intervals by the said preceding wheel, to cause the spring to move the succeeding wheel, without any strain on the preceding wheel, and wherein other mechanism is provided for positively preventing excess movement of each wheel.

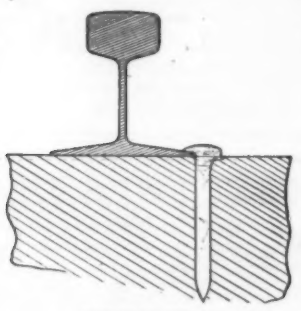
CLOCK.—B. TRIVUS, 76 Broad St., Providence, R. I. The purpose here is to provide a device which is so constructed as to strike not only hours, but subdivisions as well, so that any one in the vicinity of the clock can inform himself as to the hour or the minute at any time during the day or night, whether he can see the dial over which the hour and minute hands move or not.

CREASING AND CUTTING ATTACHMENT FOR RULING MACHINES.—J. HAYES and G. HORN. Address the former, 65 Fulton St., New York, N. Y. This invention provides means for simultaneously imprinting lines on paper and for forming creases or scores therein to form flexing surfaces; provides means for creasing and cutting paper while passing through a ruling machine without interrupting the feed or injuring the conveyer belt for supporting the paper; and provides means for driving the cutters and creasers in synchronism with the operation of said conveyer and the feed of the paper thereon.

ATTACHMENT FOR TRACES.—C. L. WOODY, Judyville, Ind. The invention provides mechanism for connecting a trace of a name in such manner that while the trace will be firmly attached to the hame the draft animal will be perfectly protected against rubbing or chafing from the metal and the metal will be held out of contact with the animal by means of the usual leather piping which covers the trace and a shield forming a part of the attachment.

Railways and Their Accessories

RAILROAD SPIKE.—A. J. D'OSTROPH, care of Camp Car No. 1, Long Key, Fla. This invention is an improvement in railroad spikes of the character used for securing rails to the ties and the object is to provide a spike which will offer a considerable resistance to the tendency of the rails to spread without injury to the tie, the spike being so constructed that it will offer a maximum of resistance to lateral thrust. The accompanying engraving shows a transverse vertical section of a rail held in place by the improved spike.



RAILROAD SPIKE.

Pertaining to Recreation

AMUSEMENT DEVICE.—A. MCK. WATERS, 55 W. 25th St., New York, N. Y. Among the objects sought to be accomplished in this invention are the provision of a hobby-horse so constructed and mounted that it is adapted to simulate the actions of a "bucking bronco"; that is so driven and operated that a multiple of hobby-horses may be driven from a common central source, the horses being arranged in concentric circles.

AMUSEMENT DEVICE.

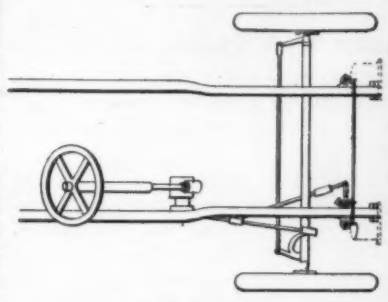
FISHING DEVICE.—K. DRINKARD, 530 Walnut St., Beaumont, Tex. The invention provides pole-supporting means that may be conveniently strapped on the body of the wearer; provides a supporting means capable of swinging movement laterally; and provides a support that may be detachably engaged with the body belt and straps in a manner to facilitate the attachment of the support and its ready adjustment for use.

Pertaining to Vehicles

DUMP CART.—H. G. BLANKFORT, 519 Putnam Ave., Brooklyn, New York, N. Y. This improvement has for its object the provision of a dump cart which can be used for ashes and garbage, the dump cart being provided with an inclosing cover which permits the body to rotate on its axis, while the inclosing cover remains stationary.

LOCKING DEVICE FOR STEERING WHEELS.—O. F. COLEMAN, care of the Universal Auto Lock Company, 419 Myrtle Ave., El Paso, Tex. This improvement relates to means for locking the steering wheel of an automobile so that the front axle may be securely held at an angle to prevent any other movement of the automobile, by unauthorized parties, than a movement in a circle or curve of small radius, or a movement against the curb if the front wheels are disposed adjacent to the curb. The invention absolutely prevents the machine from being driven forward, backed up, or towed away by another car.

HEADLIGHT CONTROL.—R. E. HARTMAN, Care of E. Z. Opener Bag Co., Orange, Tex. This invention provides mechanism for constraining the headlights of a vehicle to turn with the front wheels and in the same direction, wherein mechanism is provided in connection with the mounting of the head lights for normally holding them in straight position and for returning them to such position when they have been displaced, and wherein the connection between the turning mechanism and the steering mechanism is a lost motion connection capable of adjustment to permit the steering mechanism to move within limits without affecting the head lights.



HEADLIGHT CONTROL.

DOUBLETREE CLIP.—D. B. JACOBS, 6010 Normal Bldg., Chicago, Ill. The object here is to provide a clip arranged to securely hold the clip against slipping endwise on a doubletree or an evener, and to relieve the attaching bolt of all strain incident to the pull exerted by the draft animal.

WHEELBARROW.—W. H. PARKER, 154 Broadway, Long Branch, N. J. The object in view is the provision of an improved arrangement of parts whereby a wheelbarrow effect will be produced and also a mixing member may be provided which will mix small batches at a time and discharge the same at the point desired.

Designs

DESIGN FOR A DISPLAY-STAND.—E. L. BEHRING, Wykoff, Minn. In this ornamental design for a display-stand the stand is conical in form and constructed with wires crossing one another in graceful sweeps. The base and two exterior holders, all of saucer like shape are of the same character of construction.

DESIGN FOR A POISON BOTTLE.—P. T. BURTCHAELL, San Rafael, Cal. In this ornamental design for a poison bottle, the receptacle take the skull form with POISON printed across its forehead. One of the opposite face sides of the bottle contains a printed legend of the contents of the bottle.

DESIGN FOR A BOTTLE.—C. M. MCCLURE, care of G. Willoughby Nyal Co., Detroit, Mich. In this ornamental design for a bottle the broad and narrow presentations and the bottom show a simple yet graceful lines of an ornamental receptacle.

DESIGN FOR A STATUETTE OR SIMILAR ARTICLE.—J. F. SLAVIK, care of George Batten Co., 381 4th Ave., Manhattan, N. Y., N. Y. This ornamental design shows a statuette in erect position somewhat of the mermaid formation. It rests on a base inscribed with the legend PLOSHKIN.

DESIGN FOR A SYMBOLIC HAT.—CATHERINE L. O'LEARY, Roslyn Heights, L. I., N. Y. This ornamental design consists of a hat with tilted brim and round crown, the latter marked by a very positive stripe effect, which when combined with leaf and flower groups present a very attractive composition.

DESIGN FOR A HANDKERCHIEF.—BERTHA W. REID, Highlands, N. J. In this ornamental design the handkerchief border is featured by slightly separated squares, each holding a star. In the field of the article the corners contain warships and mounted cannon, one in each corner.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

The Electrical Exhibition and Motor Show of 1916

(Concluded from page 395)

good food makes good citizens, the United States Government took pains to show the visiting housewives how to cook food products properly. Mr. Benson, of the Department of Agriculture, was in charge of the exhibition, which represented a canning plant equipped with electrically-heated insulated ovens and fireless cookers. The United States Army and Navy were well represented with exhibits of the numerous electrical appliances that characterize the warfare of to-day on land and water.

Even the most brief resumé of the features of the recent electrical exposition would not be complete if it did not mention, in passing, the excellent vocational school exhibits, conducted under the supervision of the Board of Education of New York city. A veritable beehive of activity was the upper floor of the exposition, devoted in large measure to the young artisans at work in model print shops, in clay modelling, in sheet metal work, in commercial designing, in automobile maintenance and repair shop practice, in electric wiring, and in plumbing. Less noisy but no less busy were the girls, hard at work in such branches of vocational work as cooking, garment designing, millinery, straw and braid hat making, embroidery, button hole making, and hemstitching. Electricity was applied to almost every phase of the vocational school work, making these exhibits truly electrical.

NEW BOOKS, ETC.

THE BOY'S BOOK OF MECHANICAL MODELS. By William B. Stout. Boston: Little, Brown & Company, 1916. 8vo.; 257 pp.; illustrated. Price, $1.50 net.

There are some excellent books on toy and model making for boys, but most of them involve expenditures that the average boy's pocket book cannot meet. There is no model in Mr. Stout's book that cannot be fabricated from the odd bits of wood, wire and string that go to waste in the average home. The cigar box is quickly transformed into a cash register or an automobile; there is a telegraph that will write and a phonograph that will talk, a bear that climbs and a policeman that walks. Throughout the simple instructions runs an undercurrent of information that connects the toy with some successful invention of the grown-up world, and even the boy who confines himself to wooden elephants or wiggle bugs cannot fail to educate his hands and develop his powers of invention.

FIGHT FOR FOOD. By Leon A. Congdon, M.S., Assistant Chief Food and Drug Inspector, Kansas State Board of Health. Philadelphia: J. B. Lippincott Company, 1916. 8vo.; 207 pp. Price, $1.25 net.

The author believes in the ability of the housewife to cope with the problem of the high cost of eating. He speaks to her in untechnical language of food values, and of the importance of careful selection and the elimination of waste. But he does not confine himself to one point of view. The food laws and their enforcement, unsanitary handling and adulteration, the utilization of new products, and the relation of cold storage to high cost, are all lucidly put before the reader. The work is an interesting, practical handbook, solid rather than sensational, and offers the housewife and the householder information that will enable them to grasp the food situation intelligently and meet its problems with some degree of success.

INDUSTRIAL CONDITIONS IN SPRINGFIELD, ILLINOIS. By Louise C. Odencrantz and Zenas L. Potter. New York: Department of Surveys and Exhibits, Russell Sage Foundation, 1916. 8vo.; 173 pp. Price, 25 cents.

This bulletin of the Springfield Survey deals with such subjects as standards of living, child labor, wages and regularity of employment, hours of labor, and industrial betterment. A section is devoted to work accidents and their prevention, and there is also a careful survey of conditions based upon a hundred representative wage-earners and their families.

ECONOMIC GEOLOGY. By Heinrich Ries, A.M., Ph.D. New York: John Wiley & Sons, Inc., 1916. 8vo.; 856 pp.; illustrated. Price, $4 net.

The fourth edition of this meritorious work has been subjected to thorough revision and considerable enlargement, so that it is quite in step with recent advances in knowledge. The new material includes a description of the Canadian mineral deposits, the latest statistics of the United States Geological Survey and the Canadian Department of Mines, and other information of equal interest and value. Part I deals with the non-metallics, from coal to the minor minerals; Part II treats of ore deposits. The volume is rich in maps and illustrations, and there are extensive bibliographical references after each subject.

A LABORATORY MANUAL OF FOODS AND COOKERY. By Emma B. Matteson and Ethel M. Newlands. New York: The Macmillan Company, 1916. 8vo.; 325 pp. Price, $1.50.

This textbook deals with experimental work in such a way that the student quickly learns from it the chemical, physical, bacteriological and biological properties of foods, and the exact results of combinations and modes of preparation. A large number of thoroughly tested recipes are included. There are score cards, the use of which will train the student in accurate judgment of the finished product, and there are illustrative calculations of the nutritive values of typical cooked foods.

ISH BAR ISH. A Song of Love and Courage. By N. P. Barlow, A.B., Greenville, Mich.: N. P. Barlow, 1916. 8vo.; illustrated.

In this booklet Mr. Barlow has selected from his written verse such examples as he thinks most worthy of preservation. The long dramatic poem, "Ish Bar Ish," is succeeded by shorter examples, many of them of a personal and intimate nature.

Motor Truck Queries and Answers

P. W. N. writes: Will you please describe the operation of "cable plowing" and tell how it differs from "tractor" plowing?

Ans.—Three systems of mechanical plowing have been used, single and double engine cable plowing and by tractors. In the former, the simplest outfit consisted of a portable steam engine with windlass, rope, block carriers and anchors. These were hauled out to the field to be plowed by horses and set up. Later self-moving windlasses were used as well as self-moving anchors. The operation is simple. The multi-furrow plow is started at one end of the field opposite the windlass and is pulled across by a power operated winch. The cable may be passed through a pulley attached to an anchor at the other side from the windlass and return furrows made. The double engine system involves a power plant on each side of the field. These move along together, the five or six furrow plow being drawn across the field first by one engine, then by the other for the return trip. These systems are called "cable plowing" because the plow is pulled by ropes wound up on windlass drums by power. These sets are more used in England than in this country, as tractors are much more favored here. Cable plowing was first introduced in England in 1849 and it is stated that about 500 of these sets are in use in that country now.

A set of 14 h.p. nominal plowing engines can plow with a six furrow plow 20 to 25 acres per day, and it is capable of cultivating 50 to 55 acres per day. During a season it is estimated that the plowing and cultivating accomplished by one set will amount to 3000 or 4000 acres. Owners of these tackles usually let them out on contract at 10s. to 12s. ($2.50 to $3.00) per acre, the farmer finding coal and water. During the last year, owing to the extra cost of labor and material, the price has been somewhat higher than the figures given. It will be seen that 120 to 150 acres of land can be plowed per week and about 300 acres can be cultivated per week. It would seem that the disadvantage of the system, so far as medium farms of 300 acres are concerned, is the high initial outlay necessary, a complete set being a costly investment, unless it is intended to plow for hire, as being done in most cases in England today. A hired set, unfortunately, is only available to one farmer in a district at a time; the others must wait. Meanwhile, suitable weather may be passing.

This explains why the tractor is better adapted to the needs of the individual. The investment is so low that each farm may own its machinery and use it when conditions are best.

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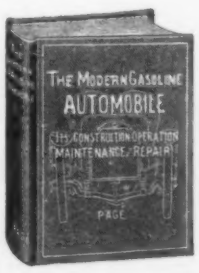

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IN THE 1916 REVISED EDITION

The subject of electrical motor starting systems has been considered at length and all leading systems and their components described. A discussion on ball and roller bearing, their maintenance and installation, has also been included, and a number of other features of timely interest such as latest types of gasoline and kerosene carburetors, cyclecar power plants, the Fischer Slide valve motor, detachable wire wheels, cantilever springs, eight and twelve-cylinder motors, new valve operating systems, Stewart-Warner vacuum fuel feed, boat type body design, leather universal joints, Entz electric transmission, positive differential, armored automobile, hydraulic brakes, etc.

Entirely new material has been added on tractors in three and four-wheel forms, cyclecars and agricultural tractors or automobile plows; combination gasoline-electric drive, front-wheel and four-wheel drive and steer systems and other important developments in power-propelled vehicles. The discussion of power transmission methods has been augmented by consideration of the skew bevel gear and two-speed direct drive rear axle, as well as several new forms of worm gear drive, etc., have been added to bring the work thoroughly up to date.

The book tells you just what to do, how and when to do it. Nothing has been omitted, no detail has been slighted. Every part of the automobile, its equipment, accessories, tools, supplies, spare parts necessary, etc., have been discussed comprehensively. If you are or intend to become a motorist, or are in any way interested in the modern gasoline automobile, this is a book you cannot afford to be without.

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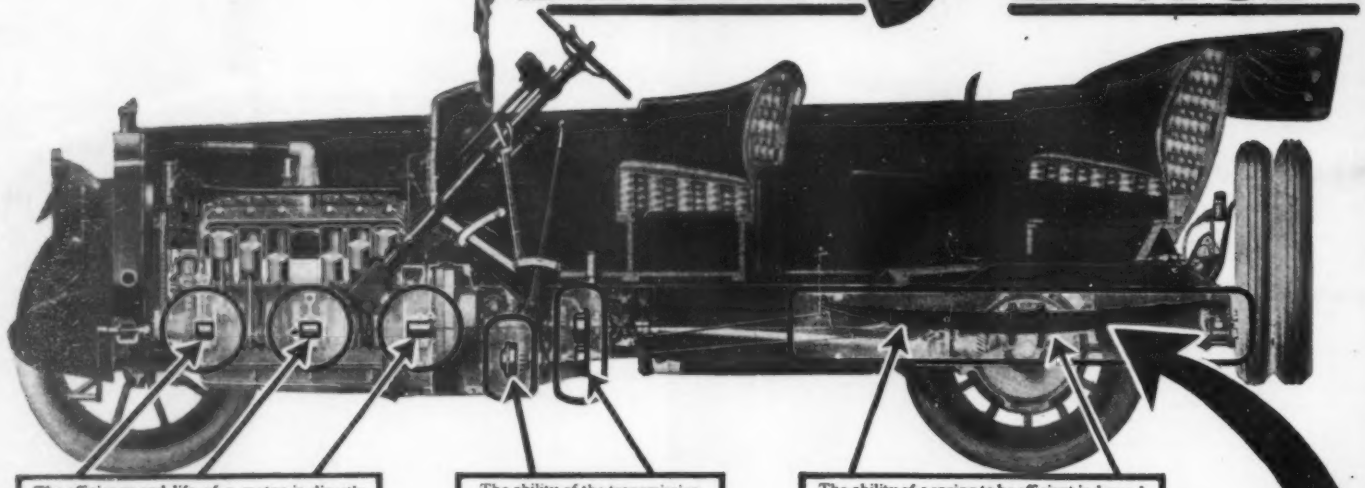

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Dann Insert is to the spring leaves what these special bearings are to the motor.

The ability of the transmission to transmit power without loss is the result of specially designed bearings for its shafts to rotate on.

Dann Insert is to the spring what these special bearings are to the transmission.

The ability of a spring to be efficient is dependent upon its leaves sliding freely upon each other. An efficient spring must be able to respond instantly to the slightest road impact.

Dann Insert, the lubricated spring-leaf bearing, is to spring efficiency what special bearings are to every other part of the car.

This BRONZE BEARING

(Self-Lubricating)

Between the Leaves of Every Spring From Tip to Tip

gives the smooth, easy, efficient spring action as necessary to the life of all the working parts of an automobile as it is to the riding comfort of the occupants. Stiff, inactive springs transmit destructive vibration, hard road shocks and jolting strain to every part of the motor, transmission and final drive system.

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Dann Insert — the bronze spring leaf bearing, self-lubricating between all the leaves of all the springs from tip to tip in any automobile gives a riding ease that cannot be obtained in any other way. The principle of efficient spring action demands a free sliding leaf motion.

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Dann Insert is a perfect spring leaf bearing of anti-friction bronze and is so constructed as to supply continuous and adequate lubrication to the entire bearing surface of the spring leaves. It fits between all the spring leaves from tip to tip. The bronze bearing metal reduces friction between the leaves to allow easy sliding of one leaf over the other. The graphite compound will not flow liquid and furnishes a lubricating surface that protects against rust and grit.

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